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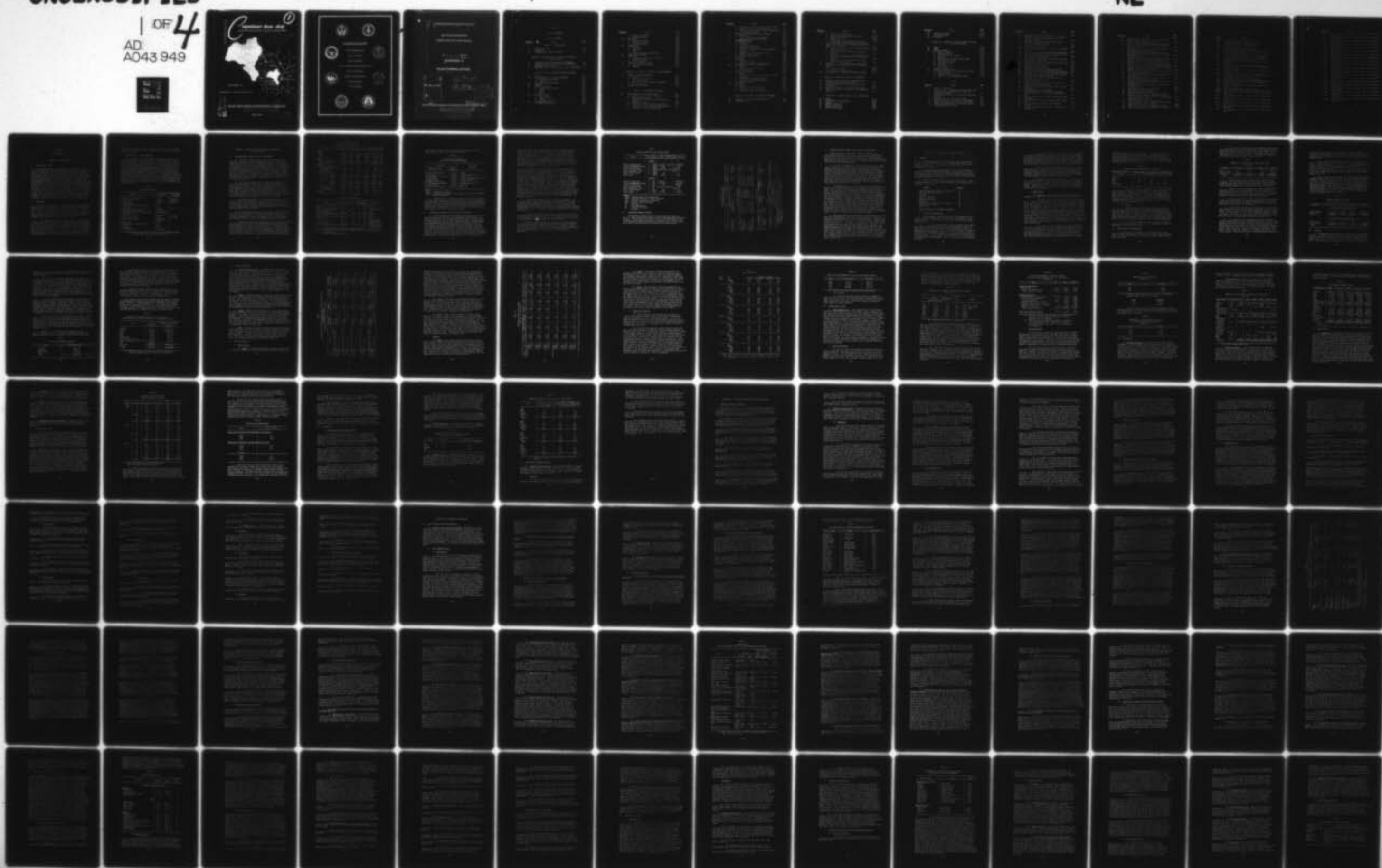
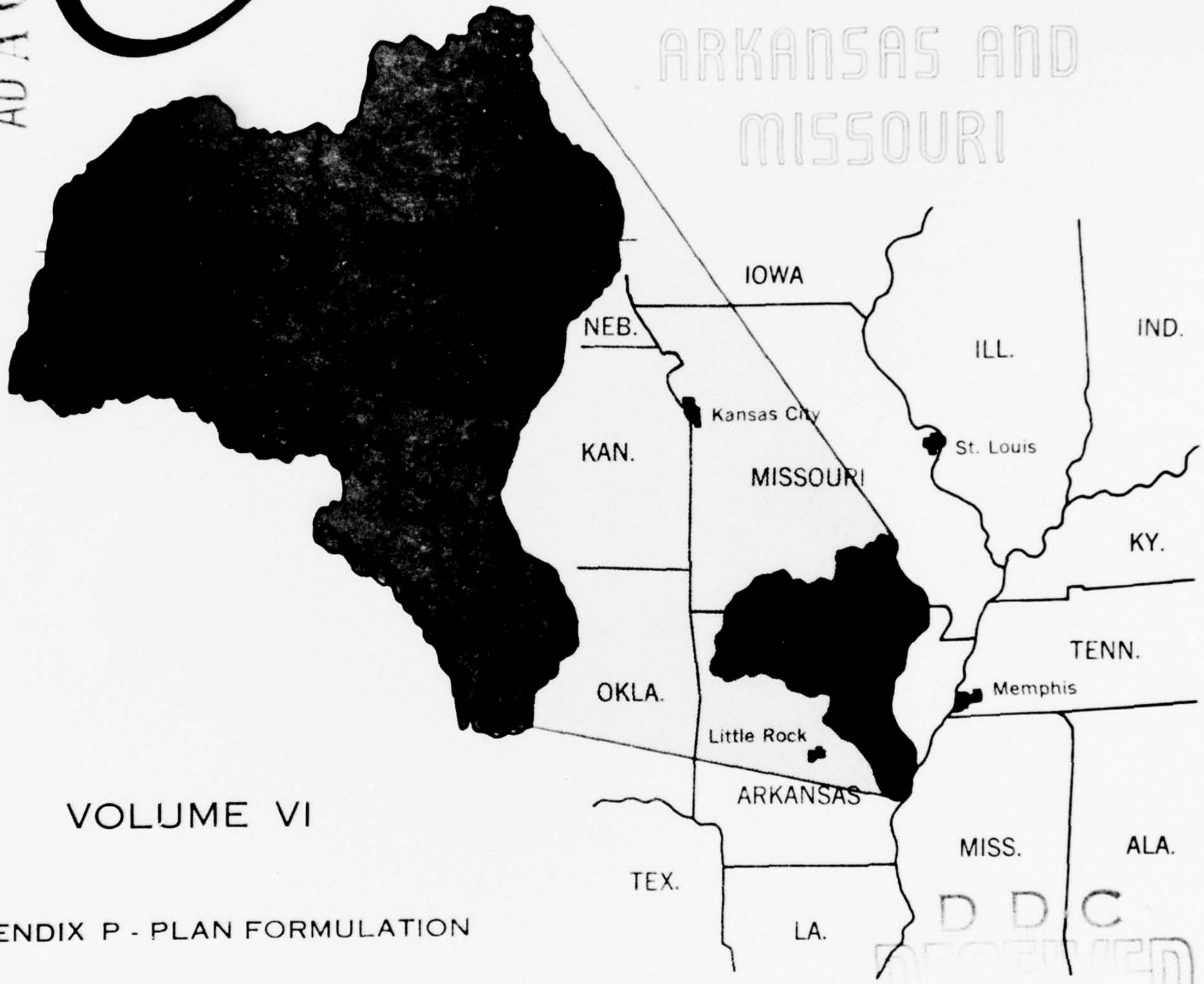


Comprehensive basin study

WHITE RIVER BASIN ARKANSAS AND MISSOURI



VOLUME VI

APPENDIX P - PLAN FORMULATION

WHITE RIVER BASIN COORDINATING COMMITTEE

JUNE 1968

COORDINATING COMMITTEE

DEPT. OF AGRICULTURE

DEPT. OF THE ARMY

DEPT. OF COMMERCE

DEPT. OF HEALTH, EDUCATION, AND WELFARE

DEPT. OF THE INTERIOR

FEDERAL POWER COMMISSION

STATE OF ARKANSAS

STATE OF MISSOURI

6 COMPREHENSIVE BASIN STUDY

WHITE RIVER BASIN

MISSOURI AND ARKANSAS

Volume VI

APPENDIX P

PLAN FORMULATION

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WHITE RIVER BASIN COORDINATING COMMITTEE

APPENDIX P

PLAN FORMULATION

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SECTION I - INTRODUCTION

1. PURPOSE AND SCOPE

This Appendix presents the examination and analysis of the physical possibilities for improvement or development of the water and related land resources in the White River Basin to meet forecasted needs and objectives. The needs are defined as the short- and long-term demand for water supply for municipal, industrial, rural, domestic, and agricultural use; water quality control; flood control and prevention; watershed protection which includes land treatment and land management; drainage; navigation, hydroelectric power; forest and mineral production; outdoor recreation including preservation of historical and scientific values; and conservation and enhancement of fish and wildlife. The advantages and disadvantages of the various physical alternatives were evaluated and when data were available a comparison of excess benefits over costs was made for the alternatives. However, in many cases the inclusion of a project or program in the comprehensive plan was determined by other factors. Because of the possible changes in the long-range projected needs and the appropriate project or program to meet them, alternative solutions are included in some instances. These alternatives are discussed in this Appendix.

2. ARRANGEMENT

a. After defining the water and related land resource problems and needs; and planning objectives, environments, and concepts; this Appendix evaluates alternatives and defines the plan of development. In so doing, a multiplicity of projects and programs are discussed. Some of these have only one purpose and others have multiple-purposes. To facilitate the discussion of the plan and its accomplishments, this Appendix generally follows the practice of discussing projects and programs by the different functional purposes served.

b. The Coordinating Committee representative of the Department of Agriculture indicated a preference in keeping material prepared by that Department on flood prevention and watershed protection together as a unit in this Appendix. This material is to serve as a basic unit for requesting authorization of the Department of Agriculture program and is included in Section VI. However, in discussing the various elements and functional plans for the basin it was necessary to discuss certain elements of the Department of Agriculture program. This arrangement results in some repetition of material, but it is necessary

in order to complete the picture of the different functional purposes served by the plan and also to comply with the desires of the Department of Agriculture.

3. RELATIONSHIP TO OTHER APPENDIXES

Plan formulation procedures were accomplished through the integration and analysis of data collected and generated in other appendixes of the report. The Appendix was compiled cooperatively by the Corps of Engineers and the Soil Conservation Service and is a contribution of the Plan Formulation Work Group established by and under the direction of the Inter-Agency Planning Committee. Table 1 lists the technical appendixes of the report, and Federal and State agencies responsible for their preparation, and those agencies, who because of parallel and allied interests, cooperated or furnished data in their preparation. As indicated by their titles, these appendixes present the detailed investigations of all facets of water resource planning considered for the White River Basin. The Plan Formulation Appendix represents the focal point of accumulation, analysis, and presentation of comparative physical and economic data leading to the recommended plan of improvement.

TABLE 1

TECHNICAL APPENDIXES

	Appendix	Responsible Agency	Cooperating Agency (1)
A	History of Investigation	CE-LRD	Mo. & Ark
B	Area Economic Study	CE-LRD	ERS,BOM,SCS
C	Hydrology	CE-LRD,SCS	USGS-WB
D	Geohydrology	USGS	
E	Mineral Resources and Mineral Industry	BOM	
F	Land Use and Watershed Protection	SCS,FS	ERS
G	Flood Problems and Losses	CE-LRD,SCS	
H	Flood Control and Flood Prevention	CE-LRD,MD,SCS	
I	Drainage	SCS	
J	Outdoor Recreation	BOR, NPS	Mo., Ark.
K	Fish and Wildlife	BSF&W	Mo., Ark.
L	Hydroelectric Power	FPC,SPA,CE-LRD	
M	Navigation	CE-MD	
N	Water Supply and Water Quality Control	FWPCA	
O	Irrigation	SCS	
P	Plan Formulation	CE-LRD,SCS	

(1) Many agencies participated in work group activities. For list of work groups see Appendix A, Plate A-1

SECTION II - CURRENT STATUS OF RESOURCE DEVELOPMENT, USE, AND PLANNING

4. EXISTING FEDERAL WATER RESOURCE DEVELOPMENTS

a. There are six main stem and major tributary reservoir projects in the basin. Beaver, Table Rock, and Bull Shoals on the Upper White River, Norfork on the North Fork River, and Greers Ferry on the Little Red River are multiple-purpose projects. Clearwater on the Black River is a single-purpose flood control project. Table Rock and Clearwater are in Missouri and the remaining four are in Arkansas. They have a total storage capacity of 16,062,000 acre-feet, of which 5,477,000 is for flood control; 3,349,000 is for drawdown for power generation; 925,000 is for drawdown for power generation and water supply; and 6,311,000 is for power head, recreation, fish and wildlife conservation, and other purposes. Pertinent data for these six projects are shown on Table 2.

b. The Federal Government has constructed nine levees on the White River and tributaries and one on the Mississippi River, the latter to provide protection for areas at the lower end of the basin from Mississippi River floods. The total length of these levees is about 166 miles and they protect about 484,000 acres of rich alluvial valley land. Pumping stations have been constructed to remove interior runoff from the area protected by four of these levees. They have a total pumping capacity of about 774,000 gallons per minute. Pertinent data relating to these projects are also shown on Table 2.

c. Navigation improvements have been constructed on the lower White, Current, and Black Rivers, but except for the lower 206 miles of the White River, these navigation projects have been placed in an inactive status because of lack of traffic. The original improvements consisted principally of snagging and dredging operations to maintain sufficient depth for light traffic.

d. The Soil Conservation Service has nine Public Law 566 Watershed Protection and Flood Prevention Projects under construction or authorized for construction. These projects consist primarily of floodwater retarding structures, drainage facilities, and associated land treatment measures. These nine projects are listed in Table 3.

e. Existing federally administered recreation, hunting, fishing, and wildlife resources include the Current-Jacks Fork Ozark National Scenic Riverways, the White River National Wildlife Refuge, five fish hatcheries, and two fisheries research stations. The Ozark National Scenic Riverways are currently under development which includes acquisition of about 87,000 acres of land and development of access and recreation facilities along about 110 miles of the Current and Jacks Fork Rivers in Missouri. The White River National Wildlife Refuge contains

TABLE 2

EXISTING CORPS OF ENGINEERS PROJECTS

MAIN STEM AND MAJOR TRIBUTARY RESERVOIRS

Item	Beaver	Table Rock	Bull Shoals	Norfork	Greers Ferry	Clearwater
General:						
Purpose	FC,P,WS	FC,P	FC,P	FC,P	FC,P	FC
Stream	White R.	White R.	White R.	North Fork R.	Little Red R.	Black R.
River mile	609.0	528.8	418.6	4.8	79.0	257.4
State	Arkansas	Missouri	Arkansas	Arkansas	Arkansas	Missouri
Drainage area, sq. mi.	1,186	4,020	6,036	1,806	1,146	898
Dam:						
Length in feet	2,575	6,423	2,256	2,624	1,704	4,225
Height, feet above streambed	228	252	258	216	243	154
Concrete, cubic yards	779,000	1,230,000	2,100,000	1,500,000	820,000	-
Embankment, cubic yards	1,610,000	3,320,000	-	-	3,000,000	5,500,000
Reservoir:						
Elevation, feet above m.s.l.:						
Nominal top of flood-control pool	1,130	931	695	580	487	567
Top of power pool	1,120	915	654	552	461	-
Nominal bottom of power drawdown pool	1,077	881	628.5	528.3	435	-
Top of conservation pool	-	-	-	-	-	494
Storage:						
Flood control - Acre-feet	300,000	760,000	2,360,000	732,000	934,000	391,000
Inches	4.7	3.5	7.4	7.6	15.3	8.1
Power drawdown - Acre-feet	925,000	1,182,000	1,003,000	448,000	716,000	-
Inches	14.6	5.5	3.0	4.7	11.7	-
Conservation or dead power - Acre-feet	727,000	1,520,000	2,045,000	803,000	1,194,000	22,000
Inches	11.5	7.1	6.4	8.3	19.5	0.5
Total - Acre-feet	1,952,000	3,462,000	5,408,000	1,983,000	2,844,000	413,000
Inches	30.8	16.1	16.8	20.6	46.5	8.6
Area in acres:						
Top of flood-control pool	31,700	52,250	71,240	30,700	40,500	10,400
Top of power pool	28,220	43,070	45,440	22,000	31,500	-
Top of conservation pool, or top of dead storage pool	15,540	27,300	33,800	16,070	23,700	1,600
Generators:						
Number	2	4	8	2	2	-
Capacity per unit, kilowatts	56,000	50,000	4- 40,000 4- 45,000	35,000	48,000	-

LEVEES AND CHANNEL IMPROVEMENTS

Projects	Stream	Mile	Length (miles)	Area Benefited (acres)	Purpose
Poplar Bluff and East Poplar Bluff, Missouri	Black River	-	4.4	(1)720	FC (Levee)
Black River, Poplar Bluff, Missouri, to Knobel, Arkansas, (Arkansas portion)	Black River	140-173	37.5	71,040	FC (Levee and 35,000 g.p.m. pump station)
Skaggs Ferry, Black River east of Pocahontas, Arkansas	Black River	94-104, 81-84	8.8	13,931	FC (Levee)
Newport, White River, Arkansas	White River	257.6	8.5	(1)2,000	FC (Levee)
Village Creek, White River and Mayberry Districts, Arkansas	White River	231.5-255	20.2	33,400	FC (Levee)
Augusta to Clarendon Levee, White River, Arkansas (2)	White River	108-197	39.4	217,000	FC (Levee)
Des Arc, Arkansas	White River	147.3	1.5	(1)	FC (Levee and 9,300 g.p.m pump station)
DeValls Bluff, Arkansas	White River	125.0	0.1	(1)	FC (Levee and 56,100 g.p.m. pump station
Clarendon City Levee, Arkansas	White River	100.6	6.0	(1)	FC (Levee)
White River Backwater Levee, Arkansas	White River	-	40.0	145,500	FC (Levee and 673,200 g.p.m pump station)

(1) Affords protection to property within city and adjacent area.
(2) Complete except for 6.6 mile section; area benefited information based on completed project.

Legend: FC - Flood control
P - Hydroelectric power
WS - Municipal and industrial water supply

112,653 acres of which 3,517 is water and the remainder is land, some of which is subject to periodic inundation.

TABLE 3

EXISTING AND AUTHORIZED
PUBLIC LAW 566 WATERSHED PROJECTS

Watershed		Structural measures
Number and name	Area (Acres)	
28 Upper Crooked Creek	56,320	19 FWR
46 Mud Creek	18,560	1 FWR and 29.9 mi. CI
69 Big Running Water Ditch	80,000	82.2 mi. CI
80 Flat Creek	23,680	5 FWR, 1 FWR&R, and 10.2 mi.CI
86 Cooper Creek	40,320	9 FWR and 3.8 mi. CI
116 Upper Culotches Bay	39,040	50.2 mi. CI
117 Big Creek-Bayou DeView	72,960	22 FWR and 8.8 mi. CI
126 Lee-Phillips	83,200	110 mi. CI
131 White River Backwater	145,920	165 mi. CI

Legend:
FWR - Floodwater Retardation
FWR&R - Floodwater Retardation & Recreation (incl. Fish & Wildlife)
CI - Channel Improvement

f. National Forest acreage in the White River Basin is about 1,200,000 acres located in the Ozark-St. Francis, Clark, and Mark Twain National Forests. Thirty-six recreational areas have been developed in these National Forests comprising about 300 acres of land and 75 acres of water. The Forest Service has also developed many hiking trails, scenic drives, and extensive portions of a statewide network of horseback riding trails within the National Forests.

5. EXISTING NON-FEDERAL WATER RESOURCE DEVELOPMENTS

a. Existing privately owned hydroelectric power plants in the White River Basin include the Taum Sauk pumped-storage project, the Ozark Beach project, and two small projects in the Spring River Basin. The Taum Sauk project of the Union Electric Company, a pumped-storage type hydroelectric power plant, was placed in operation in 1963 at river mile 300 on the East Fork Black River near Arcadia, Missouri. The installed capacity of the plant is 350,000 kilowatts. The Ozark Beach project of the Empire District Electric Company was placed in operation in 1913 at river mile 506.1 on the White River near Forsyth, Missouri. The project consists of a concrete and earthfill dam approximately 70 feet in height and a powerhouse containing four 4,000-kilowatt generating units and four empty bays available for installation of

additional units. The two small projects in the Spring River Basin, which are owned by the Arkansas-Missouri Power Corporation, were constructed about 1880. One of the dams is located on the outlet channel of Mammoth Spring. It is a masonry structure about 15 feet high and 120 feet long. The powerhouse was constructed in 1927 and contains one vertical-shaft turbine and 440-kilowatt generator. The other dam, located about 3 miles downstream on the Spring River, is a concrete buttress structure about 20 feet high and 600 feet long. The generating equipment consists of two 300-kilowatt units, one of which was installed in 1933 and the other in 1939.

b. Since the disastrous flood of 1927 practically all the flood control improvements undertaken in the White River Basin have been constructed by the Federal Government. Prior to that time the work by local interests consisted largely of the construction of levees and drainage systems although it included some bank protection and removal of snags from streams. The existing levees are located along the Black, Little Red, and White Rivers. Available information indicates that 90 drainage enterprises have been organized in the basin to serve about 1.7 million acres. Major drainage systems are mostly gravity flow systems that utilize natural streams, canals, and open ditches. Farm drainage systems usually consist of open ditches for removal of excess surface water from fields. The local levees and drainage works, in general, have not been coordinated or properly maintained. Consequently, most of the structures are inadequate and some are ineffective. Bank protection works have been constructed by local interests for the protection of railway bridges, State highways, and highway embankments.

c. Local interests have constructed works in different areas in the White River Basin in Arkansas for irrigating rice. The most extensive areas are located east of Newport and in the Grand Prairie. The irrigation development is primarily of the individual farm type. Pumping from wells is the principal source of irrigation water, although some irrigation water is obtained from small reservoirs and by diversion from streams.

d. The municipal water supply systems in the basin obtain about 53 percent of their supply from ground water sources; about 18 percent from surface water sources, which includes streams and municipal lakes; and the remainder from both ground and surface sources.

e. The two States, Arkansas and Missouri, administer numerous State parks, public hunting areas, game management areas, fish hatcheries and trout-fishing streams in the basin. A tabulation of these areas is shown on Table 4. There are also numerous municipal parks and small fishing impoundments in the basin which are tabulated in Appendix K.

TABLE 4

EXISTING STATE FISH AND WILDLIFE AREAS

Areas	No. of areas	Admin. agency	Total acres	Wetland acres	Water acres	Activity
		Arkansas				
Public hunting areas	8	AG&FC	113,500	29,400	15,600	F&H,WP
Wildlife management areas	5	AG&FC	6,980	-	-	WP
Public fishing lakes	8	AG&FC	2,489	-	2,389	F
State fish hatcheries	2	AG&FC	(warm-water production)			FP
Trout management areas	7	AG&FC	-	-	42,210	
Public access areas	21	AG&FC	80	-	-	F
Public parks	7	AP&PC	3,864	-	20	F
		Missouri				
Public hunting areas	6	MCC	108,795	-	900	F&H,WP
Wildlife management areas	5	MCC	37,257	-	40	F,WP
Public fishing lakes	3	MCC	276	-	86	F&H
State fish hatcheries	3	MCC	(trout production)		-	FP
Trout management areas	7	MCC	-	-	2,255	F
Public access areas	5	MCC	641	-	-	F
Public parks	7	MSPB	13,083	-	100	F&WP

Legend:

- AG&FC - Arkansas Game & Fish Commission
- AP&PC - Arkansas Publicity & Parks Commission
- MCC - Missouri Conservation Commission
- MSPB - Missouri State Park Board
- H - Hunting
- FP - Fish Production
- WP - Wildlife Production
- F - Fishing

6. AUTHORIZED FEDERAL PROJECTS

The authorized Federal projects in the basin are listed on Table 5. These authorized projects include 3 multiple-purpose reservoir projects, 7 local protection projects, 3 Public Law 566 projects, and the Grand Prairie Region supplemental agriculture water supply project. The 3 Public Law 566 projects are authorized for planning only.

TABLE 5

AUTHORIZED FEDERAL WATER RESOURCE DEVELOPMENTS

MAIN STEM AND MAJOR TRIBUTARY RESERVOIRS

Project	Stream	Mile	Drainage area (sq. mi.)	Total storage capacity (acre-feet)	Purpose
AUTHORIZED BY FLOOD CONTROL ACT OF JUNE 28, 1938					
Lone Rock Reservoir (1)	Buffalo River, Arkansas	3.6	1,331	687,000	Flood control
Water Valley Reservoir (2)	Eleven Point River, Missouri and Arkansas	12.6	1,152	1,563,000	Flood control and future power
Bell Foley Reservoir (3)	Strawberry River, Arkansas	26.2	520	245,000	Flood control

LEVEE AND CHANNEL IMPROVEMENT PROJECTS

Project	Authorizing Act or Acts	Type of improvement	Stream and State	Purpose
Village Creek, Jackson and Lawrence Counties	Flood Control Act of 1962	Channel improvement	Village Creek, Arkansas	Flood control
Village Creek, White River and Mayberry Districts	Flood Control Acts of 1960 and 1962	Channel improvement, pumping station, and fish and wildlife mitigation measures	Upper Taylor Bay and Tributaries, Arkansas	Flood control
Cache River Basin	Flood Control Act of 1950	Channel improvement	Cache River and Bayou, Missouri and Arkansas	Flood control
Clarendon City Levee Improvement	Flood Control Act of 1965	Levee enlargement	White River, Arkansas	Flood control
Clarendon to Laconia Circle	Flood Control Act of 1936	Levee	White River, Arkansas	Flood control
Big Creek and Tributaries	Flood Control Act of 1965	Channel improvement	Big Creek, Arkansas	Flood control
Big Creek and L'Anguille River	Flood Control Act of 1936	Levee	Upper Big Creek, Arkansas	Flood control

UPSTREAM WATERSHED PROJECTS (4)

Watershed			Structural measures		
No.	Name	Area (acres)	Floodwater retardation structures (number)	Multiple-purpose reservoirs (number)	Channel improvement (miles)
65	Little Black River	247,680	39	-	61.4
67	Fourche Creek	199,040	24	-	30.1
87	Tri-County	228,480	31	-	57.3

SUPPLEMENTAL AGRICULTURAL WATER SUPPLY

Name of project	Improvements	Irrigation area (acres)	Diversion design capacity (c.f.s.)
AUTHORIZED BY THE FLOOD CONTROL ACT OF 1950			
Grand Prairie Region, Arkansas	Pumping station, main canal, and system of distribution canals	190,000 (5)	2,200

(1) Secretary of Army has recommended that project not be constructed.
(2) Project in a deferred status.
(3) Restudied in this report for flood control, recreation, and fish and wildlife enhancement.
(4) Authorized for planning only.
(5) Approximately 125,000 acres are within the White River Basin. The remaining area is in the Arkansas River Basin.

7. CURRENTLY PLANNED FEDERAL WATER RESOURCE DEVELOPMENTS

Projects for which prior reports have been submitted and authorizing legislation is presently pending include Crooked Creek, at and in the vicinity of Harrison, Arkansas; the Buffalo National River; and the Eleven Point National Scenic River. These formally proposed projects are included in the 10- to 15-year plan and are discussed briefly in the following paragraphs.

a. The Corps of Engineers and Soil Conservation Service formulated a joint plan for Crooked Creek Basin that would meet the flood control and water supply needs at and in the vicinity of Harrison, Arkansas. The plan consisted of land treatment measures, the construction of 19 flood retarding structures, one multiple-purpose reservoir located on the East Fork of Crooked Creek, and raising the existing urban renewal levee and floodwall within the city. The Soil Conservation Service part of the plan has been approved for planning and construction. The Secretary of the Army has recommended to the Public Works Committee of the United States Senate that the Corps part of the joint plan be authorized for construction.

b. The Buffalo National River was proposed by the National Park Service in a report dated April 1963 and legislation has been introduced in both houses of the Congress to implement the Park Service proposal. The area proposed for development and administration by the National Park Service would comprise about 103,000 acres of land adjacent to the Buffalo River and would extend from its mouth approximately 128 miles upstream to the present boundary of the Ozark National Forest near Boxley, Arkansas. Adjacent lands would be acquired in fee-title or controlled by scenic easements for development of recreation facilities and preservation of scenic areas. Partial rights or scenic easements might be acquired on lands having a high agricultural value as a means of maintaining the agricultural productivity of these areas and at the same time preserving their beauty and scenic attractiveness. Development would include hiking, and nature study trails; horseback riding, and camping trails; camping, and picnicking grounds; and preservation of scenic, archaeological, and historical values.

c. The Eleven Point River was studied by the National Wild River Team of the Departments of Agriculture and the Interior for possible inclusion in the National Scenic and Wild Rivers System. Several bills have been introduced in the Congress which would designate parts of the Eleven Point River as a National Scenic River area. The upstream limit of the proposed Scenic River would be at Thomasville, Missouri. The downstream limit of the proposed Eleven Point Scenic River has been somewhat controversial with some bills proposing the lower end of the Scenic River at Missouri Highway 142. This would include 48 miles of the river. Other bills propose that the Scenic River extend to the mouth of the stream in Arkansas, about 42 miles downstream from Missouri Highway 142. Adjacent lands would be acquired in fee-title or controlled by scenic easements for development of recreation facilities and preservation of scenic areas.

SECTION III - WATER RESOURCE PROBLEMS AND NEEDS

8. GENERAL

a. An essential phase of the White River Basin study was an analysis of present and future needs or demands which can be satisfied by improvement and development of the water and related land resources of the basin.

b. In determining present needs, the effect of existing and soon to be initiated projects and programs was considered. Future needs were estimated on the basis of future conditions expected without additional Federal investment in the development of the water and related land resources of the basin.

c. Resource problems and needs are discussed briefly in the following paragraphs. More detailed information is presented in the Appendixes listed below:

Purpose	Appendix
Land Treatment and Watershed Protection	F
Flood Problems and Losses	G
Drainage	I
Outdoor Recreation	J
Fish and Wildlife	K
Hydroelectric Power	L
Navigation	M
Municipal and Industrial Water Supply	N
Water Quality Control	N
Irrigation	O

9. LAND TREATMENT AND WATERSHED PROTECTION

a. Cropland and grassland.

(1) Problems. Many problems exist concerning the conservation, treatment, and management of cropland and grassland in the White River Basin. Some of these problems are discussed in the paragraphs below.

(a) Many farms within the Ozark Plateaus of the White River Basin, because of size, are not efficient economic units. In many instances the owner must seek part-time employment in town to supplement his farm earnings. Even if he desired to place all needed conservation and management practices into use on his farm, he could not afford them. In other instances, after proper application of land treatment measures, the landowners and operators fail to provide adequate maintenance and management. This is often the case with absentee landowners.

(b) The problem of soil erosion in the Ozark Plateaus of the White River Basin is compounded by the tendency of landowners and operators to use the frequently flooded river and stream valleys for pasture and higher, steeper slopes for crop production. Abuse of the great agricultural bottom lands in the eastern part of the basin has created sediment which decreased the capacity of drainage outlets. At the same time, clearing of woodland has increased water runoff.

(c) The landowners and operators may fail to appreciate the value of certain lands for wildlife or recreation. This problem results to some extent from a lack of adequate conservation education in public schools. Also a high degree of coordination of conservation efforts has been generally lacking, not only in Federal and State programs but also by special interest groups.

(2) Needs. The entire basin suffers to some extent from erosion and from a lack of water conservation, drainage, irrigation, recreation, fish and wildlife conservation practices, and proper management. Approximately 3,388,000 acres of cropland need treatment to varying extents while 4,051,700 acres of grassland, including grazed forest land, need treatment.

b. Forest land.

(1) Problems. Some of the problems of land treatment and management on forest lands are discussed in the paragraphs below.

(a) The private forest landowner in the White River Basin is faced with many problems. Most of the original timber stands in the basin were cut during the early 1900's when the lumber industry moved into the South. Fires and abuse followed; therefore, the forest lands of the basin have not been replenished with high quality forests. Much of the timber in private ownership is of poor species, small size classes, and poor quality, and is perpetuated by the traditional practice of forest land grazing and annual burning. These practices have at the same time contributed to the erosion problems of the basin. Financial returns of any consequence from forest lands are usually many years apart. Much heavily depleted forest land in the basin needs to be restored to productivity, but restoration would require relatively high investments and long periods of waiting before financial returns could be realized.

(b) The same factors which have reduced the productivity of the forest lands in terms of timber and timber products have also had a corresponding detrimental effect on the hydrologic condition of the forest soils. The long history of destructive logging, widespread and repeated burning, and overgrazing, particularly in periods of prolonged drought, have seriously reduced soil cover and have contributed to the compaction of the upper portions of the soil

profile. The result has been a reduction of the soils' ability to resist erosion and absorb and store water. Consequently, these soils contribute high rates of soil and water runoff during storms and reduced low flows during dry periods. Active erosion was present on nearly 5 percent of the areas that have been sampled. Table 6 shows hydrologic condition of forest soils.

TABLE 6

PRESENT HYDROLOGIC CONDITION OF FOREST SOILS

Hydrologic condition class	Public lands	Private lands	Basin totals
	Percent		
Very good	3	1	1
Good	36	15	17
Fair	38	24	27
Poor	14	24	22
Very poor	9	36	33

(c) It is apparent, therefore, that, while a continued high level of protection and management is needed for public forest lands, the preponderance of forest lands in private ownership makes it essential that the levels of protection and management for these lands be increased. Only in this way will the forest lands of the basin be able to meet the wood fiber needs of the future and at the same time provide the stabilizing influence to the soil and water resources of which they are capable.

(2) Needs.

(a) The public forest lands plus the small percentage of private forests currently being managed under good forestry practices cannot meet the demands foreseen for this resource. If the projected needs are to be satisfied, a high level of protection from fire, insect, disease, and grazing damages must be afforded all forest lands and purposeful management applied to that high percentage of the forest lands of the basin now being mistreated or ignored completely.

(b) It is estimated that 590,150 acres in the basin need tree planting measures. Hydrologic stand improvements should be implemented on about 1,735,450 acres.

10. FLOOD CONTROL AND PREVENTION

a. As indicated in paragraph 4, considerable flood control works have been constructed in the White River Basin. Even with these works in operation, flooding still occurs over large areas and causes extensive damage.

b. The area under consideration for determining flood control and prevention needs is described generally as that part of the flood plains that would be flooded by a repetition of the maximum flood of record with projects in the preconstruction planning stage, under construction, or existing in operation. The extent and classification of the land in this area are shown in Table 7.

TABLE 7

EXTENT AND CLASSIFICATION OF FLOOD PLAIN LANDS
(In acres)

Reach	Cleared	Forested	Urban	Total
Ozark Plateaus	383,070	72,170	830	456,070
Coastal Plain	851,660	640,950	530	1,493,140
Total	1,234,730	713,120	1,360	1,949,210

c. Intense storms of short duration cause the most severe flooding in the Ozark Plateaus part of the basin. Because stream slopes are steep and runoff is rapid, destructive flash floods cause severe property damage, erosion of land, and often loss of life.

d. Extensive storms or a sequence of storms covering large areas and of long duration produce large volumes of runoff which descend rapidly upon the Coastal Plain. As a result of the very gradual channel slopes and low channel capacities of the Coastal Plain streams, flooding in this area is extensive and prolonged.

e. Flooding occurs several times a year in lower bottom areas of both the Ozark Plateaus and Coastal Plain portions of the basin. Floods occur most often in the months of March, April, and May, but large floods have occurred in every month.

f. The principal industry in the flood plains is agriculture. Major crops grown in the Ozark Plateaus are pasture, hay, corn, and silage. Major crops grown in the Coastal Plain are soybeans, cotton, rice, corn, and pasture. On the basis of adjusted normalized prices and present crop yields and distribution, the estimated gross annual value of crops in the area under consideration is $94,400,000.

g. Other industries and developments which are affected by floods include hardwood timber, commercial and public services, highway and county roads, railroads and utilities, and urban areas. Urban areas which have flood problems are Poplar Bluff, Cassville, Reeds Spring, Thayer, and West Plains in Missouri, and Pocahontas, Harrison, Walnut Ridge, Jacksonport, Augusta, and Clinton in Arkansas. Also, several smaller towns and communities in Arkansas and Missouri have flood problems. Springfield, Missouri, and Fayetteville, Arkansas, do

not presently have a flood problem, but future expansion into the flood plains could result in serious problems. The estimated value of property in the flood plain on the basis of adjusted normalized prices is $693,478,000.

h. Flood control and prevention needs have been estimated in terms of average annual flood losses expected under existing and future economic conditions. Economic indicators used in estimating future economic conditions were farm marketings, crop production expenses, net income per farm, per capita personal income, and in some cases, total crop sales. Changes in patterns of land use expected without additional flood control works were considered in estimating losses under future economic conditions.

i. The estimated average annual flood losses computed by flood frequency analysis under the conditions previously discussed are shown in Table 8. Adjusted normalized prices were used for both existing and future economic conditions. Due to difficulty in separating flood losses in the upstream watersheds, these estimates include damages from inadequate drainage. About 80 percent of these losses results from farming operations. Other losses result from damage to agricultural property and lands, urban property, transportation facilities, utilities, and hardwood timber. Also included in the "other" category are losses of business and gainful occupation.

TABLE 8

AVERAGE ANNUAL FLOOD LOSSES
(In thousands of dollars)

Reach	Crop	Other	Urban	Total
	Existing Economic Conditions			
Ozark Plateaus	$4,712.5	$1,161.7	$371.6	$6,245.8
Coastal Plain	24,374.1	4,987.7	15.3	29,377.1
Total	29,086.6	6,149.4	386.9	35,622.9
	Future Economic Conditions			
Ozark Plateaus	4,679.3	2,991.8	966.2	8,637.3
Coastal Plain	46,310.8	6,515.3	33.6	52,859.7
Total	50,990.1	9,507.1	999.8	61,497.0

11. DRAINAGE

a. Drainage needs, evidenced by wet lands that are frequently though not necessarily annually subject to a degree of surface or subsurface concentration of water that impairs their capacity to produce agricultural crops, exist in many low-lying areas of the White River Basin. Practically all of these areas are located in the Coastal Plain

portion of the basin. Stream slopes in this portion of the basin are very gradual, generally less than 1 foot per mile, and streams have very low capacities.

b. Most of the early drainage works in the basin were constructed during the period 1900-1930. Information indicates that over 50 drainage enterprises have been organized to serve about 860,000 acres in the basin. Many of these enterprises became insolvent during the 1930's and the drainage works have lost most of their effectiveness as a result of lack of extension and maintenance. Since Federal aid for channel improvement and upstream flood prevention became available in about 1941, there have been more attempts by local interests to construct drainage systems. Generally, these local efforts have not been fully coordinated to insure that the system installed provided maximum benefits for the funds expended.

c. One of the primary drainage problems is that major drainage systems, including the major outlets and the group main and lateral canals, do not have adequate capacities to carry the flow from farm drainage systems. This has resulted from a lack of fully coordinated and planned drainage programs. Although some channel improvement work on major outlets has been accomplished, most of them are still in their natural state. The major outlets are characterized by appreciable to severe meandering, heavy undergrowth and trees in the channel section, accumulations of debris and sediment, and insufficient channel capacity.

d. The Coastal Plain portion of the basin receives an average annual rainfall of about 50 inches with heavy rains occurring at any time of the year. In addition to heavy local rainfall, large volumes of water from the Ozark Plateaus flow onto the Coastal Plain and flood extensive areas. This water inundates low-lying areas behind the stream banks and remains for long periods of time after the parent streams have returned to within their banks because of the inadequacy of the existing drainage systems.

e. Lands in the basin with a wetness hazard are shown in Table 9. Drainage of all of this land is neither practicable nor desirable particularly with reference to the forest land and other.

TABLE 9

LAND AREAS WITH WETNESS HAZARDS

Type	Acres (rounded)
Cropland	1,650,000
Grassland	160,000
Forest land	1,610,000
Other	10,000
Total	3,430,000

f. Many farming problems are associated with inadequate drainage. Adequate surface and subsurface drainage improves the plant environment and favorably affects plant growth. Surface drainage will remove excess water before it can infiltrate into the soil and promotes better soil aeration in the root zone. As the water percolates downward through the soil profile, the space between the soil particles occupied by free water is replaced by air. This supply of oxygen in the soil is required to promote bacterial growth. Bacterial action is necessary for the conversion of nutrients within the soil into a form which can be utilized by plants.

g. Attempts to produce crops on poorly drained land lead to higher production costs as a result of reduced plant growth and yield, or loss of fertilizers, herbicides, and pesticides. Often wet conditions delay planting, cultivation, or harvesting which reduces the efficiency of the modern highly mechanized farming operation.

h. Current crop and pasture acreages with drainage problems and the average annual damages resulting from inadequate drainage are presented in Table 10. These damages are also included in the average annual flood losses presented in Table 8. The average annual damages are based on normalized crop prices, present economic conditions, cropping patterns, and farming conditions. They do not reflect benefits from land use shifts or intensified land use of drained areas.

TABLE 10

ACREAGE OF CROPLAND AND PASTURE WITH A DRAINAGE PROBLEM AND AVERAGE ANNUAL DAMAGES DUE TO INADEQUATE DRAINAGE

Crop	Acres inadequately drained	Average annual damages due to inadequate drainage
Soybeans	755,823	$10,846,060
Cotton	148,795	5,690,808
Corn	20,902	550,435
Wheat	36,825	339,237
Oats	26,352	184,337
Alfalfa hay	4,631	113,414
All hay except alfalfa	47,896	297,713
Other cropland except rice (1)	468,047	486,594
Rice	137,412	-
All crops	1,646,683	18,508,598
Pasture	164,746	19,770
Total	1,811,429	18,528,368

(1) Includes cropland not harvested, fruits, vegetables, other minor crops, and idle, fallow, and failure.

12. OUTDOOR RECREATION

a. Recreation market area. To determine the outdoor recreation needs that could be fulfilled by the resources of the White River Basin, a recreation market area was established. It is defined as the area where approximately 80 percent of the users of the White River Basin's recreational facilities reside. This area includes the 49 counties which lie entirely or principally within the drainage basin plus certain Standard Metropolitan Statistical Areas (SMSA's), as defined by the Bureau of the Budget in 1966. The selection of the SMSA's considered in this study was based on the knowledge that people from them seek recreation opportunities within the White River Basin and thereby contribute substantially to the total demand for outdoor recreation that is supplied by the basin. The recreation market area, the influencing SMSA's, and the 49 counties are shown on Figure 13 of the Main Report.

b. Demand. Recreation demand is expressed in terms of the amount and kinds of outdoor recreation facilities and activities the public desires. True demand tends to lie somewhere between what people desire and what they are actually willing to accept. It is probably nearer the latter. The total estimated annual demand in activity occasions for the four major water related activities of swimming, boating, camping, and picnicking is 18 million in 1965; 22 million in 1970; 32 million in 1980; 68 million in 2000; and 144 million in 2020.

c. Supply. Taking into consideration data on existing public and private recreation facilities in the basin, a quantitative estimate was made of the number of activity occasions that could be accommodated annually. It was found that almost 13 million activity occasions for swimming, boating, camping, and picnicking can presently be accommodated annually. By considering programmed expansion of public recreation areas, the supply for 1970 showed that a total of nearly 18 million activity occasions for swimming, boating, camping, and picnicking could be accommodated annually at that time.

d. Needs. Existing needs are the demand for outdoor recreation opportunities less the present capacity of existing resources and facilities. Projected needs are the difference between projected demand and projected supply. In short, needs are unsatisfied demand, and these are translated into resource requirements of land, water, and facilities. The facilities required to satisfy the average summer Sunday demand for recreation opportunities are shown on Table 11.

13. FISH AND WILDLIFE

a. Sport fishing.

(1) Supply. The White River Basin study area contains over 4,000 miles of clear, free-flowing Ozark Mountain streams which provide

TABLE 11

EXISTING AND PROJECTED AVERAGE SUMMER SUNDAY UNSATISFIED DEMAND AND NEEDS
(Expressed in Terms of Facilities)

Year	Activity	Swimming capacities	Boating capacities	Camping capacities	Picnicking capacities
1965	Average summer Sunday demand	95,349	86,442	41,758	116,912
1963	Supply (public and private)	59,379	87,136	16,912	54,161
1965	Needs	35,970	----	24,846	62,751
1965	Need in facilities	60(Acres)	----	4,969(Units)	10,040(Tables)
1970	Average summer Sunday demand	114,592	104,030	50,205	140,693
1970	Supply (public and private)	106,768	111,061	32,659	68,570
1970	Needs	7,824	----	17,546	72,123
1970	Need in facilities	13(Acres)	----	3,509(Units)	11,540(Tables)
1980	Average summer Sunday demand	170,203	154,460	74,561	208,898
1980	Supply (public and private)	160,768	111,061	32,659	68,570
1980	Needs	63,435	43,399	41,902	140,328
1980	Need in facilities	106(Acres)	86,798(Acres)	8,380(Units)	22,452(Tables)
2000	Average summer Sunday demand	358,135	325,931	157,016	440,753
2000	Supply (public and private)	106,768	111,061	32,659	68,570
2000	Needs	251,367	214,870	124,357	372,183
2000	Need in facilities	419(Acres)	429,740(Acres)	24,871(Units)	59,549(Tables)
2020	Average summer Sunday demand	752,697	687,421	330,337	929,471
2020	Supply (public and private)	106,768	111,061	32,659	68,570
2020	Needs	645,929	576,360	297,678	860,901
2020	Need in facilities	1,077(Acres)	1,152,720(Acres)	59,536(Units)	137,744(Tables)

high quality smallmouth bass fishing. Many of these, including the Current, Jacks Fork, Eleven Point, Spring, James, and Buffalo Rivers, accommodate the popular and unique float-fishing opportunities that have made the Ozark region famous. Trout fishing, supported by stocked fish produced at two Federal hatcheries located in Arkansas and three State hatcheries in Missouri, is available in several cold-water streams, cold-water strata of Lake Taneycomo and Bull Shoals Reservoir,.and almost 140 miles of cold tailwaters below Bull Shoals, Norfork, and Greers Ferry Reservoirs. Excellent warm-water fishing is provided in the 182,000 acres of large impoundments, 19,000 acres of natural lakes, 10,000 acres of public fishing lakes, and approximately 3,500 miles of alluvial streams in the Coastal Plain section of the basin. In addition, the private sector provides fishing potentials on 49,000 acres of small impoundments consisting of farm ponds, irrigation reservoir and floodwater retarding structures.

(2) Demand. The appraisal of fishing opportunities in the basin was based primarily on (a) the standing crop of sport fish in pounds; (b) the ratio of harvestable crop to standing crop; and (c) average catch in pounds per man day. The average annual man day per acre standards used for the various types of waters vary according to habitat quality, harvest success, degree of management, and other factors. Opportunity for trout fishing is dependent upon the rate of stocking, rate of recovery, and survival of stocked fish.

(3) Needs. Table 12 shows the projected sport fishing needs for the basin by streams and impoundments, and by total opportunities. It should be noted that the total basin demand does not exceed the total basin supply during the 50-year projection period. This is due to the large capacity or supply of the existing impoundments. However, examinations of separate parts of the basin reveal that some areas have an excess supply of available facilities while others do not. Stream capacity is exceeded near the end of the projection period which is only because of the relatively large capacity of the alluvial stream. The Ozark streams will reach capacity levels for both trout fishing and warm-water fishing by 1980. Increased pressure on these waters will reduce the quality and degree of fishing success.

b. Hunting.

(1) Supply. Under present conditions the basin contains about 21,000,000 acres of wildlife habitat, including over 12,400,000 acres of forest lands which support populations of big game, including deer and turkey, and other forest game species. The Coastal Plain supports large waterfowl concentrations on flooded rice fields, natural overflow bottom lands, and permanent waters distributed throughout the area. Public lands controlled by Federal and State agencies comprise only 9 percent of the available terrestrial wildlife habitat, with the remaining 91 percent controlled by the private sector.

TABLE 12

PROJECTED SPORT FISHING NEEDS
(Man-days in thousands)

State	Year	Large Impoundments	Small Impoundments Public	Small Impoundments Private	Natural Lakes	Ozark Streams	Alluvial Streams	Trout Waters	Total
Arkansas	1980								
	Supply	3,480	404	653	677	181	866	244	6,505
	Demand	2,284	307	240	366	181	472	244	4,094
	Needs	0	0	0	0	(1) 0	0	(1) 0	0
	2000								
	Supply	3,480	404	653	677	181	866	244	6,505
	Demand	2,640	328	270	403	211	520	286	4,658
	Needs	0	0	0	0	-30	0	-42	0
	2020								
	Supply	3,480	404	653	677	181	866	244	6,505
	Demands	3,242	364	332	474	256	612	342	5,622
	Needs	0	0	0	0	-75	0	-98	0
Missouri	1980								
	Supply	1,957	80	63	-	300	189	160	2,749
	Demand	1,692	80	31	-	300	96	172	2,371
	Needs	0	(1) 0	0		(1) 0	0	-12	0
	2000								
	Supply	1,957	80	63	-	300	189	160	2,749
	Demand	2,039	85	35	-	346	108	201	2,814
	Needs	-82	-5	0		-46	0	-41	-65
	2020								
	Supply	1,957	80	63	-	300	189	160	2,749
	Demand	2,535	93	42	-	411	126	246	3,453
	Needs	-578	-13	0		-111	0	-86	-704

(1) Capacity level for use has been reached. Demand equal to supply by 1980.

(2) Demand. The supply of hunting opportunities was evaluated on the basis of an available level and a potential level. The available level assigned equals the 1960 use (expressed demand), and recognizes that denial of public access, competing or conflicting land use, uneven distribution of hunters in the basin, and other legal or socio-economic factors which restrict use and management of the resource, will militate against realization of the full potential over the total basin area.

(3) Needs. The evaluation of hunting opportunities is based on the population density of wildlife per 1,000 acres of habitat, a sustained rate of harvest, and the hunting standards for the various types of habitat and type of game hunted. Projected hunting needs are shown in Table 13. The "A" data in the table indicate the supply and demand which can be expected to exist if current management levels and current restrictions on use continue. The "P" data indicate potential levels of supply and demand which could be achieved by removal of restrictions on use and higher levels of management. Under existing restrictions and management levels, demand for hunting opportunities will exceed supply in the very near future and throughout the projection period. However, with higher management levels and removal of use restrictions, supply could be expected to exceed demand.

c. Commercial fisheries.

(1) Total commercial fishery needs for the basin will increase considerably in future years, particularly in Arkansas because of the importance of the fish-farming industry. It is estimated the demand for catfish and bait minnows within the basin and the export market area outside the basin will increase 49 percent between 1964 and 1980. Projected on a long-range basis, demand is expected to increase fourfold by 2020.

(2) Since the fish-farming industry provides over 86 percent of the total poundage of commercial fishery products produced in the basin study area at the present time, and will be required to supply an even higher proportion in the future, a greatly expanded program will be needed to satisfy demand. The surface area of pond space needed for intensive and nonintensive operations must be increased from the existing 14,221 acres to about 164,900 acres by the year 2020. Water supply requirements will increase about fourfold from 168,000 acre-feet used at present. The water requirements for fish-farming production, based on pond area and volume of water supply, are shown in Table 14. The volume of water supply is estimated on the basis of 6 acre-feet per surface acre for intensive and 3 acre-feet per acre for nonintensive production. The preferable source of supply is from ground-water aquifers because of the greater dependability on maintaining high quality control standards necessary for efficient management.

TABLE 13

PROJECTED HUNTING NEEDS

State	Year	Man-Days (Thousands) Big Game	Small Game	Waterfowl	Total
Arkansas	1960				
	A - Supply	203	1,174	120	1,497
	Demand	203	1,174	120	1,497
	Needs	0	0	0	0
	1980				
	A - Supply	173	1,082	113	1,368
	Demand	234	1,303	134	1,671
	Needs	-61	-221	-21	-303
	P - Supply	1,013	1,664	113	2,790
	Demand	234	1,303	134	1,671
	Needs	0	0	-21	0
	2000				
	A - Supply	166	1,070	113	1,349
	Demand	260	1,452	150	1,862
	Needs	-94	-382	-37	-513
	P - Supply	974	1,661	113	2,748
	Demand	260	1,452	150	1,862
	Needs	0	0	-37	0
	2020				
	A - Supply	160	1,056	113	1,329
	Demand	301	1,678	172	2,151
	Needs	-141	-622	-59	-822
	P - Supply	933	1,659	113	2,705
	Demand	301	1,678	172	2,151
	Needs	0	-19	-59	0
Missouri	1960				
	A - Supply	106	515	14	635
	Demand	106	515	14	635
	Needs	0	0	0	0
	1980				
	A - Supply	105	508	14	627
	Demand	123	587	15	725
	Needs	-18	-79	-1	-98
	P - Supply	617	792	14	1,423
	Demand	123	587	15	725
	Needs	0	0	-1	0
	2000				
	A - Supply	104	506	14	624
	Demand	141	671	16	828
	Needs	-37	-165	-2	-204
	P - Supply	613	789	14	1,416
	Demand	141	671	16	828
	Needs	0	0	-2	0
	2020				
	A - Supply	104	501	14	619
	Demand	162	770	19	951
	Needs	-58	-269	-5	-332
	Supply	610	785	14	1,409
	Demand	162	770	19	951
	Needs	0	0	-5	0

A - Supply - Available supply level with average existing level of management and restriction on use.

P - Supply - Potential supply level realized with a higher level of management and removal of restrictions on use.

TABLE 14

WATER SUPPLY REQUIREMENTS TO SATISFY FISH-FARMING NEEDS(1)

Year	Surface acres	Acre-feet
1964	42,221	168,000
1980	81,401	341,000
2000	110,262	464,000
2020	164,844	702,000

(1) Based on the expected pounds of fish produced per acre of water.

(3) Commercial fishing in natural waters is hampered by legal restrictions, inefficient harvesting gear, unstable market conditions, and other factors. These problems must be resolved in order to realize the resource potentials required to satisfy the demand for other commercial fishery products.

14. HYDROELECTRIC POWER

a. Power supply Area K. Power supply areas as established by the Federal Power Commission for power market surveys, hydroelectric power need and utilization studies, and other analyses of power supply and requirements represent geographical areas substantially representing the electrical service areas of major electric utilities. Usually a power supply area encompasses a combination of utilities that operate in close coordination under a common holding company or under other pooling arrangements. In the development of the National Power Survey, power supply areas were combined into coordination study areas to facilitate studies of extra high-voltage transmission, coal field steam electric generating stations, the more adequate utilization of hydroelectric capacities, and other broad factors affecting the future development of the electric utility industry. Federal Power Commission Coordination Study Area K is the market area for power produced in the White River Basin. It includes all of Arkansas and Louisiana, practically all of Kansas and Oklahoma, southern half of Missouri, western half of Mississippi, and a small area in east Texas. Coordination Study Area K is a logical combination of power supply areas inasmuch as it substantially represents the area covered by the Southwest Power Pool and associated systems.

b. Power requirements.

(1) The historical and estimated future data on energy for load, peak demands, and annual load factors for Study Area K are presented in Table 15. The peak demand for Area K increased from 2,890 megawatts in 1950 to 13,070 megawatts in 1965. Estimated future load growth as developed for the National Power Survey is expected to reach 35,900 megawatts by 1980. This estimate has been trended to the year

2020 for the White River Basin Comprehensive Study and the expected load at that time is estimated at 182,000 megawatts. The annual load factors decreased between 1950 and 1963. This was due principally to the advent of residential and commercial air-conditioning. This trend appears to be reversing at this time and moderate increases in load factors are expected in the future due partly to load-building activities of the electric utility industry.

TABLE 15

HISTORICAL AND ESTIMATED FUTURE POWER REQUIREMENTS
(Study Area K)

Date	Energy for load Million kw.-hr.	Peak Demand Megawatts	Annual load factor %	Peak month(1)
1950	15,402	2,890	60.8	Aug., Sep., & Dec.
1955	27,519	5,347	58.8	July, Aug., & Sep.
1960	40,207	8,352	54.8	July & August
1965	62,687	13,070	54.8	July
1970	93,270	19,300	55.2	August
1980	178,900	35,900	56.7	August
2000	462,000	93,000	56.7	August
2020	904,000	182,000	56.7	August

(1) Depending on sub-area in Study Area K.

(2) Existing utility generating plants in Study Area K in 1965 had a dependable capacity of 15,730,941 kilowatts. Of this total, 84.6 percent or 13,314,340 kilowatts is steam-electric, 9.2 percent or 1,448,500 kilowatts is hydroelectric, 4.9 percent is internal combustion, and 1.3 percent is gas turbine capacity. Throughout Coordination Study Area K, a large number of industries own and operate their own generating plants. The installed capacity for industry-owned generation in the area as of December 31, 1965, amounted to 1,796 megawatts of steam-electric capacity, and 268 megawatts of diesel-electric capacity making a total of 2,064 megawatts. Total generation during 1965 was 13,955 million kilowatt-hours. Industry-owned generation is not a part of the public power supply, but is given consideration in projecting future electric utility load levels.

(3) Some of the existing generating plants will be retired for various reasons, such as increased operation cost and need for building space. In general, retirement age for generating units is assumed to be 35 years. Retirement age subsequent to 1980 involving high-pressure high-temperature equipment may be lowered to 30 years. A summary of the capacity requirements, capacity available, and additional capacity required to meet the power requirements in 1965, 1970, and 1980 is shown in Table 16.

TABLE 16

ADDITIONAL DEPENDABLE CAPACITY TO SUPPLY
ESTIMATED ELECTRIC UTILITY LOADS IN STUDY AREA K
(Megawatts)

Item	1965	1970	1980
Capacity requirements			
Peak demand	13,070	19,300	35,900
Reserve requirement (12%)	1,568	2,316	4,310
Total capacity required	14,638	21,616	40,210
Capacity available			
Existing fuel-electric 12-31-65	14,282	14,282	14,282
Less estimated requirements	0	934	1,460
Net fuel-electric	14,282	13,348	12,822
Existing hydroelectric 12-31-65	1,442	1,442	1,442
Scheduled fuel-electric additions	0	9,273	9,273
Scheduled hydroelectric additions	0	508	1,385
Imports of firm power	448	(1)1,525	(2)2,525
Total capacity available	16,172	26,096	27,447
Additional capacity required	-1,534	-4,480	12,763

(1) SCEC-TVA Seasonal Capacity Agreement. Hydroelectric capacity diversity from NPS Study Areas I and L estimated to be 25 megawatts.

(2) SCEC-TVA capacity diversity estimated to increase to 2,500 megawatts by 1980. Hydroelectric capacity diversity from NPS Study Areas I and L estimated to be 25 megawatts.

c. Peaking capacity.

(1) Hydroelectric plants are admirably suited to supplementing base-load thermal plants on high peak short duration loads. Hydroelectric projects have several important advantages over thermal plants, especially for peak generation, in that they do not consume water or fossil fuels, do not contribute to water or air pollution, have low operation and maintenance costs, have the ability to start quickly and meet load changes readily, and provide other corollary benefits. There is a growing need for peaking capacity throughout Study Area K.

(2) The projected load curves indicate that during the peak month of August the hydroelectric power capacities shown in Table 17, which are in excess of the capacity of existing and scheduled facilities, could be utilized on the load at a 20 percent plant factor. This is in the peak area of the load where hydroelectric generation is so advantageous and is a measure of the amount of hydroelectric capacity needed for a well-balanced electric power system for Study Area K.

TABLE 17

HYDROELECTRIC POWER CAPACITY
(Megawatts)

Year	Amount(1)
1980	4,240
2000	14,240
2020	29,640

(1) Of these amounts the following could be in adjoining pumped-storage hydroelectric capacity:

Year	Megawatts
1980	2,670
2000	6,920
2020	13,540

(3) It is estimated that preference customers of the Southwestern Power Administration, the marketing agency for federally developed power in the basin, could utilize the capacities of hydroelectric power shown in Table 18.

TABLE 18

HYDROELECTRIC CAPACITY THAT CAN BE USED
IN SUPPLYING PREFERENCE USER LOAD
(Megawatts)

Year	Amount
1980	460
2000	2,430
2020	5,990

15. NAVIGATION

a. Navigation problems. The White River is very crooked throughout its entire length. There are many bends with a radius of less than 1,000 feet. These bends, coupled with the existing project channel dimensions, are definite restrictions to the size and the length of the tows which may be expected to successfully navigate the stream. Under the existing project, efforts are made to maintain a navigable depth of 4-1/2 feet from the mouth to Augusta, Arkansas. This limits the type of cargo and towing vessels which may move on the river. Currently, cargo vessels in use for moving soybeans and grain are capable of carrying 1,200 tons when loaded to a draft of 8-1/2 feet.

Lighter loading, for example to 6 feet, reduces the cargo capacity to 900 tons with a corresponding reduction in transportation savings.

b. Existing commerce. Commerce movement on the White River during the 6-year period 1960-1965 averaged 498,659 tons annually. The commodity movements on the river during this period are shown in Table 19. Normally, traffic on the White River consists of one- and two-barge tows, powered by 600 to 700 horsepower towboats. The barges are 195 feet long and 35 feet wide.

TABLE 19

COMMERCE ON WHITE RIVER - PERIOD 1960 THROUGH 1965
(In tons)

Type cargo	Movement	1960	1961	1962	1963	1964	1965
Soybeans	Out	56,816	69,923	86,226	56,314	55,816	54,026
Rice	Out	13,888	651	-	8,045	-	-
Wheat	Out	-	-	2,700	1,122	1,460	1,613
Sand, gravel & crushed rock	Inbound	-	-	-	-	-	64,240
Sand, gravel & crushed rock	Local	139,600	179,300	285,200	194,700	202,200	195,400
Logs	Out	3,990	-	1,800	13,309	-	16,744
Logs	Local	19,818	29,916	42,715	43,329	35,641	44,169
Waterway improvement material	Out	79,368	54,368	116,203	41,468	160,752	268,868
Waterway improvement material	In	-	-	-	485	-	168,451
Waterway improvement material	Local	-	-	-	42,055	61,624	39,340
Limestone	Out	-	-	-	-	-	25,465
Other	Out	-	1,186	4,099	-	2,042	-
Other	In	-	-	-	-	1,450	390
Other	Local	1,692	147	136	82	242	545
Total(1)		315,172	335,491	539,909	400,909	521,227	879,251

(1) 6-Year average 498,659 tons.

c. Potential commerce. A preliminary estimate of potential waterborne commerce was developed for a channel with a minimum depth of 9 feet (100 percent of the time) and a 150-foot bottom width. The commerce of the "base year" (1965) was developed from a limited waterway traffic survey and a study of production and consumption of the various commodities in the area. The preliminary estimate of commerce that would have been shipped on an improved waterway in 1965 was 3,221,000 tons. The major portion of this would be outbound commerce. Projection of

waterborne commerce is based on the expected growth of economy within the area. Table 20 shows the prospective commerce to which the area may look forward.

TABLE 20

PROSPECTIVE COMMERCE IN TONS

Commodity	1965	1970	1980	2000	2020
Soybeans	450,110	540,130	801,200	1,323,320	1,773,430
Rice	447,500	492,250	537,000	604,130	671,250
Wheat	30,930	39,400	48,510	82,380	112,010
Corn	12,800	8,930	6,700	6,700	6,700
Oats	4,720	2,720	1,660	1,280	850
Barley	500	700	970	1,520	2,070
Sand and gravel	568,900	648,550	813,530	1,587,230	2,315,420
Crushed stone	1,245,000	1,419,300	1,780,350	3,473,550	5,067,150
Cotton	5,250	5,930	7,300	10,190	13,440
Cotton by-products	19,400	21,920	27,000	37,640	49,660
Cement	12,500	13,500	14,880	19,000	25,630
Fertilizer	79,000	85,500	106,500	154,200	201,600
Coal	219,000	438,000	2,190,000	3,285,000	4,380,000
Petroleum	3,000	3,240	3,570	4,560	6,150
Wood and wood products	100,130	93,120	101,130	189,250	260,340
Metals	22,320	24,110	26,560	33,930	45,760
Total (rounded)	3,221,000	3,837,000	6,467,000	10,814,000	14,931,000

16. WATER SUPPLY

a. Municipal. In 1965, the urban areas of the White River Basin used an average of 48 million gallons of water per day (m.g.d.) for domestic, service and commercial business, and small industrial water supply needs, representing approximately 6 percent of the total water used in the basin. Based on the expected increase of population in the area and an expanding per capita water use, it is estimated that the water requirements for municipal purposes will increase to about 66 m.g.d. by 1980, and to about 141 m.g.d. by 2020. To date, existing facilities have been developed in the basin to supply approximately 163 m.g.d. for municipal supply from reservoirs, rivers, springs, and ground-water aquifers. One-third to one-half of the municipal supply in 1965 was obtained from ground water and spring flow. In viewing these water needs basin-wide it would appear that sufficient resources have been developed to supply the municipal and light industrial needs beyond the year 2020. However, there are areas which have insufficient water supplies to meet projected demands of even the immediate future due to their location, lack of ground-water availability, and anticipated rapid growth of urban population.

b. Industrial. Water-using industries projected for the area will further increase the need for additional water resource development prior to the year 1980. Water demands for these industries, not generally supplied by public water supply systems, are expected to approach 76 m.g.d. by the year 1980, and 116 m.g.d. by the year 2020.

c. Rural. Rural water use within the basin for domestic and livestock purposes was approximately 33 m.g.d. in 1965, which represented about 4 percent of the average daily water use in the basin. It is estimated that rural water demands, exclusive of irrigation, will increase to about 50 m.g.d. by 1980 and remain relatively constant to the year 2020. The higher demand will result from maintenance of higher living standards rather than any anticipated population growth. At present, about 90 percent of the rural water supply is obtained from privately owned wells. Other sources are from farm ponds, cisterns, and streams.

d. Total water supply requirements. Estimates of total future water supply requirements for the water supply areas are shown on Table 21. The water supply areas for the basin are delineated in Appendix N.

17. WATER QUALITY CONTROL

a. Pollution of streams in the White River Basin at the present time is not extensive or widespread. This is because of the comparatively small population concentrations, few industries, and the high sustained flow of the White River and its major tributaries, on which most of the larger communities are located. Most water-using industries in the basin are located within the corporate limits of cities, and discharge their waste through municipal treatment systems. The most important of these industries is food and kindred products engaged principally in processing poultry, dairy, and beef products.

b. Some pollution problems do exist in the basin, however, as a result of inadequate or overloaded municipal waste treatment facilities and various industrial and agricultural operations. Pollution results from dairy feedlot operations; where cattle wastes have been allowed to enter streams and ground-water formations; from industrial operations, where raw wastes, excavated materials, and gravel washings have been dumped into streams; and from agricultural operations, where pesticides and herbicides have been sprayed directly on streams or washed into streams after application. Pollution has caused fish kills in some streams by depleting oxygen, rapidly changing temperatures, and introducing toxic materials. Other indications of pollution are increased turbidity in some streams and increased concentrations of nitrates and other plant nutrients in some ground-water and surface-water supplies.

and generation of hydroelectric power. Except for hydroelectric wer.

TABLE 21

PROJECTED WATER REQUIREMENT
(Million gallons per day)(1)

Year	Area	Municipal	Industrial	Total M&I	Rural
1980	1	12.7	16.8	28.4	7.4
	2	18.5	18.2	36.7	6.4
	3	2.8	6.6	9.4	5.6
	4	1.6	1.6	3.2	2.3
	5	3.0	2.2	5.5	3.0
	(2)6	-	-	-	-
	7	12.8	25.4	38.2	8.7
	8	9.6	2.5	10.6	10.0
	9	4.8	3.1	7.9	6.7
	Total	65.8	76.4	139.9	50.1
2000	1	21.0	21.0	42.0	7.4
	2	27.1	23.2	50.3	6.6
	3	4.8	7.1	11.9	5.6
	4	2.4	1.6	4.0	2.3
	5	5.0	2.3	7.3	3.0
	(2)6	-	-	-	-
	7	19.5	31.7	51.2	8.7
	8	13.0	3.0	16.0	10.1
	9	7.2	6.2	13.4	7.0
	Total	100.0	96.1	196.1	50.7
2020	1	29.2	25.3	54.5	7.4
	2	38.1	29.4	67.5	6.6
	3	6.9	7.4	14.3	5.7
	4	3.5	1.6	5.1	2.3
	5	6.2	2.4	8.6	3.1
	(2)6	-	-	-	-
	7	28.7	37.9	66.6	9.2
	8	18.2	3.5	21.7	10.6
	9	9.9	8.4	18.3	7.5
	Total	140.7	115.9	256.6	52.4

(1) All quantities represent in-basin use.
(2) Area omitted from investigation.

c. Growth and expansion of cities and industries in the White River Basin will intensify water pollution problems in many instances. Some streams, largely intrastate tributaries to the White River, will have inadequate low flows to properly assimilate projected waste discharge. Even though effluents from urban and industrial complexes may receive a high degree of waste treatment, they will still cause critical

oxygen depletion in streams where dilution waters are inadequate. Such conditions create health hazards and are highly detrimental to further use of streams for municipal and industrial water supply or for fish and wildlife and general recreation purposes.

d. Streams that will be particularly susceptible to this condition will be those receiving treated waste discharges from large beef, poultry, and dairy products industries expected to have extensive expansion and development in the Ozark Plateaus area of the basin. Streams of the basin where severe problems are anticipated and where supplemental flows should be provided include the James River downstream from Springfield, Missouri, to Table Rock Reservoir and the White River downstream from Fayetteville, Arkansas, to Beaver Reservoir. Water quality control needs in terms of supplemental flow requirements for these locations are shown in Table 22. These needs are in excess of natural stream flows based on a 20-year drought recurrence interval.

TABLE 22

WATER QUALITY CONTROL NEEDS

Year	Water required (million gallons per day)
White River downstream from Fayetteville, Arkansas	
1980	5.1
2000	8.6
2020	12.5
James River downstream from Springfield, Missouri	
1980	5.6
2000	14.1
2020	27.4
Totals	
1980	10.7
2000	22.7
2020	39.9

e. Many small cities and rural communities located in the headwaters of tributary streams have localized pollution problems. They include West Plains, Willow Springs, Mountain Grove, Seymour, and Ava in Missouri, and Harrison, Jonesboro, Walnut Ridge, and Green Forest in Arkansas. Effluents from waste treatment are discharged into streams which have little or no flow except where they are spring-fed. Effluents from those located in the Coastal Plain portion of the basin

are discharged into broad flat channels where runoff is sluggish and channel slopes are very gradual. Streams are stagnant much of the time and cannot satisfactorily assimilate pollution loads.

f. Warmer temperatures in the White River below Bull Shoals and Norfork Dam, when there may be no significant power-water releases for 2 or 3 days, as on holiday weekends, have caused fish kills during the midsummer according to the Arkansas Game and Fish Commission. In that reach of the river where native fish could not adapt to the colder water from the reservoirs a valuable trout fishery has been substituted. The losses have occurred despite modification of power operations insofar as possible, consistent with the authorized project purposes.

g. Irrigation and large scale fish-farming operations also create pollution problems, particularly in the Coastal Plain portion of the basin. Return flows from these operations contain varied pollutants, including dissolved solids, sulfates, chlorides, nitrogen, and phosphorus.

18. IRRIGATION

a. Irrigable area and source of water.

(1) There are about 1,786,000 acres in the Coastal Plain portion of the basin suitable for irrigation. The most expansive single area is known as the Grand Prairie Region of Arkansas. More than half of this region lies on a wide ridge or terrace on the right bank of the White River downstream from the vicinity of DeValls Bluff, Arkansas. This terraced land comprises about 877,000 acres and is the principal rice-growing area of the Grand Prairie Region.

(2) All of the Coastal Plain portion of the basin is in a humid climate having an average annual precipitation of about 50 inches. Under normal conditions water supplies are adequate for general agricultural productions, but rice culture, which is of primary importance in the area, requires an alternate flooding and drainage of the land and poses a special problem in supply and control of agricultural water. Provision of supplemental water for dry crop farming is in the experimental stage but holds substantial possibilities of future development because of frequent droughts during the growing seasons.

(3) In addition to the area suitable for irrigation in the Coastal Plain portion of the basin, there are some 26,000 acres in the Ozark Plateaus portion suitable for irrigation. Due to the frequent flooding of the bottomland, irrigation in this area is confined to the higher terraces along the streams and to the relative flat interfluve areas. The sources of water are irrigation reservoirs, farm ponds, springs, and perennial streams. There were about 280 sprinkler irrigation systems in use in the area in 1964. These systems were used for supplemental irrigation on high income crops.

(4) The most important source of irrigation water is the aquifers consisting of sands and gravels of the Quaternary age. These underlie the Coastal Plain portion of the basin in thickness ranging from a few to about 400 feet. These aquifers were required to supply some 705,000 acre-feet of irrigation water in 1964 for irrigation of about 436,000 acres. When their use for irrigation purposes first began, the water was confined under artesian pressure by overlying impervious clays. However, at present, a free water table exists over most of the region as a result of pumping in excess of recharge inflow.

(5) These ground-water supplies are being rapidly depleted. It is indicated that on a regional basis the supply will be adequate to furnish the present withdrawal only for about 20 years. However, significant local areas may encounter problems in obtaining water from wells before then.

b. Water requirements. The estimated supplemental irrigation water use in acre-feet per acre per year that were used in arriving at supplemental irrigation water needs is presented in Table 23.

TABLE 23

ESTIMATED SUPPLEMENTAL IRRIGATION WATER USE
(Acre-feet per acre per year)

Crop	Average	Drought year (20% chance of occurrence)
Rice	2.0	2.5
Cotton	1.0	2.0
Soybeans	0.75	1.5
Other	1.0	1.5

c. Irrigation needs. Irrigation needs are estimated on the basis of lands which can profitably use additional water for crop production and are physically suited for irrigation. It is assumed that the lands will be essentially flood-free and adequately drained. Table 24 shows the historical and projected water requirements for the White River Basin, using the estimated annual water requirements shown in Table 23 for an average year and a drought year.

TABLE 24

PROJECTED IRRIGATED ACREAGE AND WATER REQUIREMENTS

Use	Irrigated area(1)	Water requirement	
		Average year	Drought year
	1,000 acres	1,000 acre-feet	
1964			
Rice	233	466	582
Cotton	46	46	92
Soybeans	144	108	216
Other	13	13	20
Total	436	633	910
1980			
Rice	240	480	600
Cotton	80	80	160
Soybeans	300	225	450
Other	20	20	30
Total	640	805	1,240
2000			
Rice	235	470	588
Cotton	85	85	170
Soybeans	330	248	495
Other	25	25	38
Total	675	828	1,291
2020			
Rice	230	460	575
Cotton	90	90	180
Soybeans	340	255	510
Other	25	25	38
Total	685	830	1,303

(1) Includes acreage in the Grand Prairie authorized project.

19. VECTOR AND ANNOYANCE PROBLEMS

a. Reasons for consideration. The principal reasons for consideration of vector problems associated with the White River Basin water and related land resource developments are: (1) to prevent conditions suitable for transmission of vector-borne diseases, and (2) to safeguard the comfort and well-being of the public.

b. Problems.

(1) Malaria formerly was of serious incidence in Arkansas and Missouri, but during recent years there has been no significant malaria

transmission in these States or any other State of this country. Significant densities of the malaria mosquito (Anopheles quadrimaculatus) still exist throughout the White River Basin. Therefore, a resurgence of malaria is an ever present threat as long as travelers and military personnel bring malaria parasites into this country.

(2) Mosquito-borne encephalitis has not been recognized as a public health problem in the White River Basin, but the St. Louis strain of this disease represents a threat in view of the prevalence of the vector - Culex quinquefasciatus (Southern house mosquito) - in the area.

(3) Two important tick vectors in the area are Amblyomma americanum (lone-star tick) and Dermacentor variabilis (American dog tick). These species are vectors of Rocky Mountain spotted fever and tularemia.

(4) Annoyance problems are especially pertinent in connection with the development and utilization of outdoor recreation areas. Past experience has demonstrated that scourges of mosquitoes - such as flood-water species (Ades vexans) and ricefield mosquitoes (Psorophora confinnis) - can be a real impediment to recreational developments. Other arthropods and rodents that may create serious nuisance problems in recreational areas include: deer flies, biting midges, wasps, ticks (especially the lone-star), chiggers, ground squirrels, rats, mice, and chipmunks.

SECTION IV - PLANNING ENVIRONMENTS AND CONSIDERATIONS

20. GENERAL PLANNING ENVIRONMENTS

The primary conditions and influences affecting the formulation of the plan were (a) the objectives to be met, (b) the physical characteristic of the basin, (c) time or projection periods involved, (d) present and future economic development, and (e) procedures used. These are discussed in the paragraphs below.

a. Objectives. The objective of plan formulation was to develop a comprehensive plan which would serve as a guide for the best use of the water and related land resources of the basin to meet all foreseeable short- and long-range needs. To accomplish this objective the Coordinating Committee adopted the following planning concepts.

(1) A coordinated comprehensive plan for the time-phased development of the water and related land resources of the White River Basin through the year 2020 would be formulated and presented in the report.

(2) Elements of the comprehensive plan should be compatible with each other and should provide an arrangement of projects and programs flexible enough to meet the changing pattern of needs that would undoubtedly result from unforeseen demands placed on the environment of the basin.

(3) Full and equal consideration would be given to all purposes which could be served by water and related land resource development.

(4) In determining the composition of the plan, each separable component should be considered on the basis of the contribution it would make in net benefits to the White River Basin, the States of Arkansas and Missouri, and the entire Nation.

(5) All benefits and costs, both tangible and intangible, would be given full consideration in arriving at the recommended comprehensive plan.

(6) The plan would recognize expressed desires of local people and protect their rights and interests as well as those of the States and the Nation in determining the development of water and related land resources and the preservation and protection of established uses.

(7) The plan would include existing, authorized, and formally proposed projects and programs of Federal and non-Federal agencies which were compatible with the balanced comprehensive development and use of the water and related land resources of the White River Basin.

(8) It would be recognized in the plan that additional studies might be required for some projects and programs to support specific recommendations for State or Federal authorization or development by private interests.

(9) Provisions should be made for a periodic review of the comprehensive plan. This review would serve as a basis for keeping the plan current and for subsequent action.

b. Physical characteristics. Probably the most influencing factors affecting the formulation of a plan for development of the White River Basin are those which are under the category of "physical characteristics." Under this broad category are such factors as surface topography which has an important ecological effect on the location and activities of man and the distribution and capacity of the existing major water control structures in the basin. These are discussed below.

(1) Topography.

(a) The White River Basin comprises about 27,765 square miles in the southern part of Missouri and in the northern and eastern parts of Arkansas. The basin lies within two major physiographic divisions; the Interior Highlands and the Atlantic Plain, each of which is further divided into provinces and sections. Most of the Interior Highlands in the White River Basin is within the Ozark Plateaus Province. To the east the Interior Highlands Division is separated from the Atlantic Plain Division by the fall line. Below the fall line the White River Basin lies within the Mississippi Alluvial Plain section of the Coastal Plain Province.

(b) The Interior Highlands include about three-fourths of the White River Basin and is characterized by plateau surfaces entrenched by steep-walled valleys. The topography of the Coastal Plain is characterized by flat monotonous plains traversed by sluggish meandering streams. One important physiographic feature in the Coastal Plain, Crowley's Ridge, forms part of the eastern border of the basin and rises as much as 200 feet above the general level of the plain. The land surface of the rest of the Coastal Plain is made up principally of terrace deposits and flood-plain deposits of Quaternary age of the Mississippi River and its tributaries. The land surface slopes generally southward and descends from an altitude of about 320 feet at Poplar Bluff, Missouri, to about 150 feet at the mouth of the White River. Poplar Bluff lies near the fall line close to the northern extremity of the Coastal Plain portion of the basin and about 200 airline miles from the mouth of the White River.

(c) The White River Basin can be separated hydrologically and geographically into three major drainage areas. This separation as well as the separation of the Ozark Plateaus and Coastal Plain is often used in this Appendix as well as other appendixes to clarify

planning environments. The three areas are the White River and tributaries upstream from the mouth of the Black River, the Black River and tributaries, and the White River and tributaries downstream from the mouth of the Black River. The drainage areas of each are 11,272, 8,520, and 7,993 square miles, respectively. The total length of the White River is approximately 728 miles of which about 463 miles is above the confluence of the Black River. The Black River is about 315 miles in length.

(d) Nearly all of the White River above the mouth of the Black River drains the Ozark Plateaus area. Only a small portion below Batesville, Arkansas, is in the Coastal Plain. The area is characterized by plateaus which have been cut by numerous streams that have eroded to depths of several hundred feet in places.

(e) Although the Black River traverses the Coastal Plain for about 210 miles, nearly two-thirds of its length, only a small part of the basin lies within the Coastal Plain. This is because the stream closely follows the fall line on its right bank from about Poplar Bluff to its mouth. On the left bank it is closely paralleled by the White River tributaries that enter the White River downstream from the mouth of the Black River. All tributaries of consequence below Poplar Bluff enter the Black River from the right bank and all head in the Ozark Plateaus area entering the Coastal Plain only a few miles above their mouths. In the 210 miles from Poplar Bluff to its mouth, the Black River changes only about 134 feet in elevation.

(f) Below the mouth of the Black River the White River drains mostly Coastal Plain streams except for its major tributary, the Little Red River. Approximately 75 percent of this lower White River area is in the Coastal Plain. Most of the tributary streams in this reach of the White River originate on the alluvial plain and have very little slope throughout their entire length. In the 265-mile reach of the White River from its mouth to the mouth of the Black River, the surface elevation changes only about 71 feet. This is only during low water conditions on both the White and Mississippi Rivers. During extreme high water on the Mississippi River, a backwater extends upstream on the White River for about 165 miles.

(2) Existing projects.

(a) Locations and pertinent data on existing projects in the basin were included in Section II of this Appendix. These projects have a major effect on the environment and planning for future development of the land and water resource of the basin. Large main stem and tributary Federal reservoirs have done much to stimulate recreation activities and will help meet future water supply needs in surrounding areas of the basin. Power produced at the projects is used throughout the region to meet peak power demands. Through their flood control effects they have had a major influence on land use and cropping

practices in the lower White River Basin. Their location and planned operation are of major consequence when planning for future development of water and related land resources.

(b) Four of the existing six large main stem and major tributary reservoirs of the basin are located on the White River and tributaries above the mouth of the Black River. These four reservoirs, Beaver, Table Rock, Bull Shoals, and Norfork, provide 4,152,000 acre-feet of flood control storage. The tandem system of Beaver, Table Rock, and Bull Shoals on the main stem of the White River control the runoff from the 6,036 square miles above the Bull Shoals Dam with the flood control storage in these reservoirs which is equivalent to 10.6 inches of runoff above Bull Shoals. The Norfork project controls 1,806 square miles of the North Fork River drainage with a flood control storage equivalent to 7.6 inches of runoff above the Norfork Dam. Existing control amounts to about 70 percent of the White River drainage area above the mouth of the Black and about 36 percent of the entire drainage of the basin.

(c) The Black River Basin has a far less regulatory degree of control with only one existing main stem and major tributary reservoir, Clearwater project at river mile 257.4, and one existing Public Law 566 watershed project, Flat Creek, which contains 6 floodwater retardation structures. The Clearwater project controls about 10 percent of the total drainage area of the Black River Basin. Its flood control capacity of 391,000 acre-feet is equivalent to 8.1 inches of runoff from the drainage area upstream from the dam.

(d) The existing Greers Ferry Reservoir on the Little Red River affords the only flood control storage on the lower White River or tributaries. This reservoir has a flood control capacity of 934,000 acre-feet which is equivalent to a runoff of 15.3 inches from the upstream drainage area of 1,146 square miles.

(e) With regard to water oriented impoundment-type recreation, the four reservoirs in the upper White River Basin provide a large majority of the supply. At the top of the conservation pool (power pool) these reservoirs have a total water surface area of 138,750 acres. The Clearwater project has a conservation pool surface area of 1,600 acres, and the Greers Ferry project has a surface area of 31,500 acres at the top of the power pool.

(f) Operation of the reservoirs has also had a considerable effect on downstream water quality and the period that water is available. The hydroelectric power intakes for the five Federal power projects draw cold water from the lower stratum of the reservoirs. Water temperatures of these releases seldom if ever exceed about 55 degrees Fahrenheit. As a result the ecology of the streams below the projects for some distance has been affected. The warm-water fishery below Bull Shoals on the White River, below Norfork on the North Fork River, and below Greers Ferry on the Little Red River have been replaced by trout fisheries.

(g) During the summer months the power projects are used to meet peak load demands brought about by the rapidly increasing air-conditioning load in the area. To meet load requirements the projects use the stored waters, thus downstream flows are materially greater than they would have been under unregulated conditions. While power operations are somewhat curtailed during other periods of the year, power releases augment downstream low flows above what they would have been under unregulated conditions. Thus, in addition to regulation of flood flows, the projects through power operations reduce long periods of flow fluctuations and provide more water in downstream reaches for irrigation, navigation, and other water uses.

c. Projection periods.

(1) A comprehensive study of regional scope requires more than an evaluation of the water and related land resource problems and needs under current conditions of demand and supply. Consideration had to be given to interpretation of the total problem in terms of balancing the water product needs of a growing population and associated economic trends by means of a program of water development which would provide for the satisfaction of such needs over a given period of growth. Accordingly, projections of population, personal income, and industrial and agricultural activity were made. The results of these studies are presented in Appendix B, "Area Economic Study."

(2) The economic projection period used for the White River Basin was 50 years, terminating at 2020 with intermediate points of projection at 1980 and 2000. However, Senate Document 97 indicates that the economic evaluation of a project shall encompass the period of time over which the project will serve a useful purpose. To firm up and lend credence to the assessment of benefits to projects which were considered to have an economic life of over 50 years, primary reliance was placed on reasoned extrapolation of the economic projections for the first 50-year period.

d. Present and future economic development.

(1) Historically the resources of the White River Basin have been principally used in agricultural production. Recently the importance of manufacturing and other nonagricultural activities has increased. Projections of future economic activity indicate that the importance of all nonagricultural activities will continue to increase.

(2) The 1960 population of the 50-county study area which is composed of 49 counties wholly or partly in the drainage basin, plus Pulaski County, Arkansas, is projected to increase from about 1,188,000 to 2,400,000 in 2020. The study area is shown on Figure 1, Appendix B. It was estimated that in 1960 the basin population was about evenly divided between the Coastal Plain and the Ozark Plateaus. This is projected to be the same in 2020.

(3) The urbanization and population growth projected to occur will result from increasing nonagricultural employment opportunities in urban areas. Declines in agricultural employment will be accompanied by expanding job opportunities in manufacturing, trade, service, and other categories. Total employment is expected to about double by the year 2020.

(4) Per capita personal income is projected to increase from $1,410 in 1960 to $7,590 in the year 2020. This substantial increase will mean a much higher average standard of living for the basin residents. This higher standard of living will be accompanied by increasing demands for various water resource development functions, such as more flood control, water supply, water quality control, power generation, outdoor recreation, and fishing and hunting opportunities.

(5) The value in 1960 dollars of all farm products sold in the study area is projected to increase from $578,000,000 in 1964 to $1,609,000,000 in 2020. Crop production which is concentrated in the fertile bottom lands of the Coastal Plain is projected to increase from $359,000,000 in 1964 to $826,000,000 in 2020. Principal crops include cotton, rice, and soybeans. The production of livestock and livestock products, which is concentrated in the Ozark Plateaus, is projected to increase from $219,000,000 in 1964 to $783,000,000 in 2020. Poultry and poultry products are the major components of these sales.

e. Procedures used.

(1) Ad hoc work groups composed of representatives within the various Federal and State agencies involved in the study identified water and related land resource needs in excess of those being met by existing, under construction, authorized, and proposed projects and programs and determined the areal extent of these unsatisfied needs. The individual agencies participating in the study then made preliminary or reconnaissance-type investigations to determine possible solutions for meeting the unsatisfied needs within the field for which they have authority. The multiple-purpose aspects of all possible solutions were considered in order to develop a balanced plan. Each agency also determined a tentative priority and timing for their projects and programs.

(2) It was recognized that close coordination and cooperation among the various Federal and State agencies involved in the study would be required in formulating a comprehensive plan for development and use of the water and related land resources of the White River Basin. Therefore, a Plan Formulation Work Group was established to study and evaluate agency proposals for meeting the basin needs and, where necessary, to resolve conflicting proposals. The work group also reached conclusions as to the urgency of meeting the water and related land resource needs of the basin and designated priorities for more detailed studies. The Plan Formulation Work Group was composed of representatives from participating Federal agencies and the States.

(3) Existing, under construction, and certain of the authorized and proposed projects were a necessary part of the comprehensive plan to help meet future needs. The proposed and additional projects and programs selected for the comprehensive plan by the Plan Formulation Work Group were divided into two time-phased categories based on the urgency of meeting the needs. One category, an early action plan, contains projects and programs which should be initiated within the next 10 to 15 years. A second category, the long-range plan, contains other projects and programs which for one reason or another are not so urgently needed. Individual agencies made detailed engineering and economic studies for those projects and programs included in the 10- to 15-year plan.

(4) Because of various interests and responsibilities of the many agencies and the States participating in the study, there were diverse views on some of the elements considered in developing the plan. Most of the conflicts were resolved. However, the long-range plan contains some alternative projects and programs which could be developed in the future if certain projects and programs in the 10- to 15-year plan are not initiated.

21. PLANNING CONSIDERATIONS

a. In formulating the plan to satisfy the needs of the basin for the products and services of water resource development, a variety of measures were considered. These measures fall into four distinct categories:

(1) Major control impoundments to regulate streamflow in the principal watercourses;

(2) Flood control, flood prevention, and watershed protection projects in upstream reaches of tributary areas;

(3) Levee and channel improvement projects for flood control and drainage; and

(4) Measures and programs for conservation or enhancement of fish and wildlife, enhancement of recreation, and preservation of archaelogic, historic, and natural science values.

These four types of measures are not entirely independent of each other since, in many cases, they act together to contribute to the overall effectiveness of the plan. However, in selecting the appropriate project or program, consideration was given to economic and other factors such as scope of improvements, desires of local interests, position of the States, and pending Federal legislation relating to the basin.

b. In addition to regulation of flood flows, all major impoundments on the principal water courses were investigated for other purposes such as recreation; fish and wildlife enhancement; domestic, industrial, rural, and agricultural water supply; water quality control;

and generation of hydroelectric power. Except for hydroelectric power, the watershed investigations on small dams were for the same purposes.

c. In studying solutions to meet the needs there were many physical, legal, economic, and design objectives and constraints to be observed. These are outlined below by functional purposes.

(1) Flood control.

(a) Investigations included all potential solutions for meeting flood control, flood prevention, and watershed protection needs. These solutions included land treatment measures, small dams and reservoirs, large dams and reservoirs, channel enlargement, levees, floodways, and flood plain management.

(b) All multiple-purpose aspects of water resource development were considered in project formulation of the dam and reservoir projects.

(c) For major reservoirs the greatest amount of flood control storage that was economically feasible was provided.

(d) For small retarding-type reservoirs the amount of flood control storage was based on a minimum of 25-, 50-, and 100-year flood volumes, depending on their classification as to downstream risks.

(e) Protection of urban areas by levees was based on a Standard Project Flood.

(f) Protection of rural areas by levees was based on a flood with a 50-year recurrence interval to the extent practicable and economically feasible.

(g) The design of multiple-purpose flood protection and agricultural water management channels was based on a discharge that would occur on the average of about once in 2 to 5 years during the growing season.

(2) Water supply.

(a) In planning for water supply, consideration was given to future demands for all water-use needs.

(b) Where projections indicated storage was necessary, reservoirs were investigated in terms of the cost of the storage. The amount of storage required was based on constant rate of withdrawal or yield produced over the longest recorded period of sustained low flows originating on the contributing drainage area.

(c) In areas where there appeared to be sufficient streamflow and ground water of sufficient quantity and quality to meet foreseeable needs, no investigations were made for reservoir storage.

(d) Where streamflow appeared insufficient to meet projected needs and new storage was impracticable, other sources of water, such as ground water or piping from existing reservoirs, were considered.

(e) The water supply potential of long-range projects was considered in meeting long-range water supply needs.

(f) The quality of water supplies developed from streamflow met the standards of purity required by the Public Health Service.

(3) Water quality.

(a) The need for supplemental streamflow or alternative pollution control measures to protect existing and projected uses of the streams, to protect the streams from further degradation, and to enhance water quality were determined on the basis of the States' adopted Water Quality Standards.

(b) The needs for supplemental flow for water quality control were based initially on a waste treatment effectiveness of at least 90 percent, with recognition that a higher degree of treatment may, in the future, become generally feasible.

(c) Storage for water quality control was provided where feasible in areas where the need has been determined and where provision of such storage is in accord with the desires of the respective States.

(4) Hydroelectric power. It was determined that the hydroelectric power that could be developed economically could be utilized to meet system needs.

(a) Conventional.

1. Consideration was given to the hydroelectric power potential of all reservoirs.

2. Firm or primary energy was based on the most critical period of record with proper adjustment for reduced head due to peaking operations.

3. The average annual energy was based on the streamflow period of record adjusted to at-site conditions and for upstream development as necessary.

4. For design of hydraulic turbines the design head was based upon the average head during the critical hydro period, modified where required by economic considerations, and reservoir operations for other purposes.

5. The power drawdown or storage was compatible with other project purposes.

6. For screening studies, the plant factor during a critical year was assumed to be 5 percent based on the assumed dependable capacity.

(b) Pumped storage. It was determined that investigations of survey quality should be outside the scope of this report.

(5) Navigation.

(a) The estimate of potential waterborne commerce on the White River was based on the assumption that channel dimensions and alignments would be compatible with the interconnected inland waterways system of the United States. The channel would have a minimum depth of 9 feet 100 percent of the time and a 150-foot bottom width.

(b) It was assumed that other features of the comprehensive plan should be compatible with slack-water navigation on the lower White River. However, the appropriate navigation plan and its economic justification would be outside the scope of this report.

(6) Irrigation.

(a) Adequate flood protection and drainage systems were necessary for areas to be irrigated.

(b) Irrigation in the upland areas will be in small plots and will require erosion control measures due to the steep topography. Sprinkler systems are usually used to apply the irrigation systems in such areas.

(c) Net irrigation requirements were determined on a probability basis. The requirements were influenced by economic considerations and climatic conditions.

(d) Irrigation systems were designed to provide adequate water during peak-use periods. Peak-use rates usually occur in the basin during a 30-day period starting in the latter part of July. For purposes of estimating peak-water requirements, it was assumed that rice will require 11 inches, soybeans 12 inches, and cotton 15 inches of irrigation water during this 30-day period.

(e) Future ground water use for irrigation was assumed to remain about constant and equal to the 1965 rate of withdrawal.

(7) Drainage.

(a) The design of channels for flood control and agricultural water management was based on the assumption that a shallow

accumulation of water is not damaging to some crops if the period of inundation does not exceed about 24 hours after the cessation of rainfall.

(b) The drainage ditches were designed to provide relief from storms of a recurrence frequency of about once in 2 to 5 years.

(c) Drainage systems were planned to extend from main outlets to drainage field ditches. This would include project construction of major outlets and group drainage systems and local on-farm construction consisting of farm main and lateral ditches and drainage field ditches.

(d) Grade stabilization structures were planned at the ends of outlet ditches and at points of entry of concentrations of water directly into planned channels.

(e) Channels were designed for flow velocities ranging from 0.7 to 0.6 feet per second.

(8) Recreation and fish and wildlife.

(a) Investigations on reservoir projects included recreation and fish and wildlife enhancement as parallel purposes.

(b) Existing natural resources of the basin for recreation and fish and wildlife were protected as much as practicable and all resources were utilized in a complementary manner.

(c) Consideration was given to the recreational potential of the existing projects.

(d) Preservation of areas of archeologic, historic, and natural scenic beauty.

(e) Preservation of as many of the natural scenic streams in the basin as possible within the framework of overall prudent development of the water and related land resources of the basin.

(f) More equal distribution of recreation resources within the basin.

(g) Increased access and facilities for recreation and fish and wildlife purposes.

SECTION V - DEVELOPMENT OF THE PLAN

22. FLOOD CONTROL AND FLOOD PREVENTION

a. Objective and solutions considered. The objective of the investigation was to find economically feasible solutions to satisfy flood control and prevention needs to the extent practicable. In determining the most practicable solution, alternative measures were considered and evaluated. Solutions considered included small dams and reservoirs, large main stem and major tributary reservoirs, levees, major channel improvements and outlets, including channel enlargement, cutoffs, floodways, combinations of these and other engineering works, and flood plain management. In studying the various solutions, consideration was given to meeting other water and land resource needs of the basin.

b. Joint investigations.

(1) Impoundments.

(a) The studies for flood control and prevention by means of storage were made by the Corps of Engineers and the Soil Conservation Service, using two types of projects. The Corps of Engineers investigated use of large holding reservoirs on the main stem and principal tributaries to provide flood control. The Soil Conservation Service investigated floodwater retarding structures in upstream watersheds for flood control and prevention. For some flood plains a combination of both types of structures was considered in order to provide a higher level of economical flood protection for the largest area and the most people.

(b) When it was appropriate to make joint studies, investigations were first made to determine the effects of the larger reservoirs and the floodwater retarding structures on the flood problem, when functioning separately. Then logical combinations of the large and small structures were tested against the results from the separate studies. In screening studies, the comparison of results was in terms of reduction in cubic feet per second at applicable locations. In the more detailed studies, comparisons were also made in terms of dollar benefits. The location of areas benefited was a factor in making joint studies. The floodwater retarding structures provided flood control and prevention at locations farther upstream than provided by the large reservoirs because of their location. The larger reservoirs provided flood control farther downstream than the retarding structures, mainly because of location and holding ability.

(c) Other joint investigations by the Corps of Engineers and the Soil Conservation Service were made for combinations of floodwater retarding structures, levees, and channel improvements. These investigations were coordinated between the two agencies and adjustments made if required, taking into consideration sociological aspects as well as the desires of the people involved. The principal objective of these investigations was to insure compatibility of the different parts of the joint plans and complementary effects in respect to flood control and prevention.

(2) Agricultural water management and major flood control outlets.

(a) Where major flood control outlets were required to accommodate the agricultural water management systems necessary to remove or control access water, joint studies were made by the Soil Conservation Service and the Corps of Engineers.

(b) In planning the on-farm and lateral channels, the objective was to prevent damages from flooding that would occur during the growing season about once in 2 to 5 years, or about an average of once in 3 years.

(c) The major outlets were then planned to carry the same discharges as provided for in the upstream channels. All major outlets are tributaries to either the White River or one of its alluvial tributaries. Consequently, the capacity of these outlet channels is affected by backwater to varying degrees. Because river levels may be expected to be above bankful for long periods, no attempt was made to design these major outlets for backwater. Even during periods of low water, slopes along the major outlets are flat. Therefore increases in stage along these outlets would be small during periods when affected by backwater.

c. Procedures for evaluation of projects and programs.

(1) Reservoir regulation.

(a) In the operation of storage reservoirs for flood control, the inflows were either experienced flows at the location of the reservoir, flows on the same stream adjusted for differences in locations, or flows constructed from rainfall, soil conditions, and flows on adjacent watersheds. Because the reservoir effects were to be defined by their effects on downstream peak-discharge frequencies, the floods chosen to be analyzed in detail were carefully selected to be representative of the frequency spectrum and also to be representative of historical floods in respect to volume.

(b) The schedule of reservoir releases from the larger reservoirs was based on downstream channel capacities. Consequently, in the analysis of high volume, long duration floods, periods in excess

of 4 months were studied. When reservoir storages were exceeded, the reservoirs with gated spillways were operated to induce surcharge storage to obtain the greatest amount of peak reduction at appropriate regulating stations.

(c) The design of the spillways for the floodwater retarding structures was based on downstream channel capacities, allowing for discharge from similar structures that would discharge into the same channel. The same floods were routed through the floodwater retarding structures as were analyzed for the larger flood control structures.

(2) Channel routings. The releases from both the larger flood control reservoirs and the floodwater retarding structures were routed downstream. If flood routing methods varied, the most applicable was used for individual reaches. In all instances where there were downstream gages, natural flows were reproduced by routing the floods used in the frequency analysis. The reductions in flow were then routed using the same procedure.

(3) Assignment of benefits. When a combination of a large reservoir and floodwater retarding structures was included in a specific plan, the benefits resulting therefrom were based on an analysis with all projects in the system functioning together. Then, the large reservoir and the retarding structures were evaluated on a first added basis. The benefits for the total system were then assigned to the large reservoir and the retarding structures in the same proportion as the benefits of each on a first added basis.

d. Projects considered.

(1) Soil Conservation Service flood prevention and watershed protection.

(a) In their investigations for flood prevention and watershed protection the Soil Conservation Service subdivided the White River Basin into 26 reaches containing 136 watersheds of 250,000 acres or less. An inventory was made of all land treatment, flood prevention, and agricultural water management channel requirements in these watersheds. A preliminary evaluation of providing improvements in all these watersheds was made first and then feasible projects were integrated with other proposed improvements in the basin. Feasible projects, which were determined to be compatible with other improvements and those which were determined to furnish the greatest benefit to the basin as a whole, were included in the plan for development in the next 10 to 15 years. Others that are not economically justified at this time are included in the long-range plan. All necessary land treatment measures were included in the 10- to 15-year plan.

(b) The 26 reaches investigated by the Soil Conservation Service along with the 136 watersheds are shown on Plate 20 of this Appendix. As mentioned previously, the entire program of the Department of Agriculture is contained in Section VI. However, certain features of that program are discussed here because of their relationship as alternatives or projects selected.

(2) Main stem and major tributary reservoirs.

(a) There were a relatively few main stem and major tributary reservoirs investigated by the Corps of Engineers for flood control in the White River Basin. There are several reasons for this. The most important is that past studies in the basin indicated where the best sites for large reservoirs are located, where the projects are most needed for control of floods, and the relative value of the projects. These past studies included hydrologic investigations, surface and sub-surface geology, and economic data which generally pointed the way to the most favorable project site in any specific reach or tributary area.

(b) Several potential reservoir sites were eliminated after a cursory investigation indicated very little possibility of economic justification, now or in the future, because of excessive costs involved in relocations of railroads, major highways, and in some cases, towns or communities. Alternatives to these sites were sought but were not always available.

(c) The existing National Scenic Riverways on Jacks Fork and Current Rivers eliminated further consideration of two large multiple-purpose reservoir projects on the Current River which past studies indicated would be very effective for flood control. The possibility that additional streams might be designated National Rivers was considered, but did not affect the early determination of reservoir projects to be considered.

(d) After consideration of the foregoing factors a list of 22 potential main stem and major tributary reservoirs was assembled for further investigation as additions to the flood control plan for the basin. This list does not include the East Fork Dam and Reservoir project which was reported on in a prior report; see paragraph 7, Section II, for discussion. All of these projects were also investigated for other possible purposes. Additional main stem and major tributary reservoir projects which would serve hydroelectric power and other purposes are discussed in a subsequent paragraph of this Section along with the disposition of these projects. The reservoir projects considered for additions to the existing and previously planned system of reservoirs for regulation of floods in the basin are presented in Table 25.

(e) After a brief examination of the projects listed in Table 25, eight were eliminated from further consideration. The

main reason was lack of economic feasibility or that there was a more suitable alternative. These projects are discussed below.

TABLE 25

MAIN STEM AND MAJOR TRIBUTARY RESERVOIRS CONSIDERED

Project name	Stream	River mile
Trigger Gap	Kings River	48.0
Grandview	do	34.6
County Line	James River	107.8
Turner Station	do	101.2
Kinser Bridge	do	96.7
Finley Creek	Finley Creek	19.0
Galena	James River	50.2
Crooked Creek	Crooked Creek	26.0
Gilbert	Buffalo River	59.5
Lone Rock	do	3.6
Piney Creek	Piney Creek	2.0
Wolf Bayou	White River	311.4
Polk Bayou	Polk Bayou	5.0
Harviell	Cane Creek	17.6
Fairdealing	Little Black River	37.4
Doniphan	Current River	55.0
Warm Fork	Warm Fork Spring River	4.6
Myatt Creek	Myatt Creek	2.2
Wild Horse	South Fork Spring River	14.9
Janes Creek	Janes Creek	9.2
Bell Foley	Strawberry River	27.2
Clinton	Archey Fork, Little Red River	1.4

(f) The Trigger Gap project at river mile 48.0 on the Kings River was eliminated in favor of the downstream Grandview project where considerably more storage could be developed at less cost. Stream gradients increase upstream from the Grandview site resulting in the need for higher and more costly dams for development of comparable storage in upstream sites.

(g) On the upper James River three sites were investigated for purposes of flood control, water supply, water quality control, recreation, and fish and wildlife. The two lower sites, Kinser Bridge at mile 96.7 and Turner Station at mile 101.2, were eliminated in favor of the County Line site at mile 107.8. Economic development of storage at both the lower sites was limited by extensive residential development in the upper elevations of the reservoir areas. Cost of development of the Kinser Bridge site would be further increased by extensive relocations of the St. Louis-San Francisco Railroad which crosses the valley just above the dam site.

(h) Final cost estimates for the County Line project indicated that it could be constructed for a cost of about \$60 per acre-foot of storage. Preliminary estimates for Kinser Bridge and Turner Station indicated costs of \$155 and \$232 per acre-foot, respectively. On this basis these projects are not economically justified at this time. The Kinser Bridge project was left in the plan as a possible long-range development for future water supply for the city of Springfield, Missouri.

(i) A flood-control-only project was authorized for the Lone Rock site in 1938. An Interim Report on the Buffalo River was submitted in December 1964 which included data and findings on the multiple-purpose projects at the Gilbert and Lone Rock sites. The Governor of Arkansas at that time opposed the construction of a reservoir project on the river and favored using the stream as a National River. In view of this position, the Secretary of the Army recommended that Gilbert not be authorized and that Lone Rock not be constructed. The Gilbert and Lone Rock projects were dropped from further consideration in this comprehensive study in favor of the Buffalo National River as described in paragraph 7b.

(j) In the Black River Basin the Warm Fork Dam and Reservoir project on the Warm Fork of the Spring River was eliminated from consideration after a brief reconnaissance-type investigation which indicated that this stream was not a heavy contributor to downstream floods. The cavernous nature of the surrounding terrain and the apparently small channel indicated considerable runoff loss to sinkholes during heavy rainfall periods.

(k) On Archey Fork of the Little Red River in the lower part of the White River Basin the Clinton Reservoir was eliminated from further consideration after a preliminary investigation showed that it was far from justified. As the reservoir site is located just upstream from the Greers Ferry Reservoir its flood control effects would have been immaterial in the lower Little Red and White Rivers below Greers Ferry. The project would have furnished flood control and water supply for the town of Clinton, Arkansas. However, studies indicated less costly alternatives for both purposes.

(l) Of the remaining 16 reservoir projects considered, cost and benefit studies indicated 8 could not be economically justified at this time. However, these 8 projects were retained in the plan for possible long-range development on the basis of their need and that changing economic conditions might result in their justification in the future. These 8 projects are discussed further in paragraph 22f.

(m) The 8 projects which showed economic justification and were further considered for possible development in the next 10 to 15 years were County Line, Wolf Bayou, Harviell, Fairdealing, Myatt

Creek, Wild Horse, Janes Creek, and Bell Foley. Of these 8 projects Wolf Bayou was the only one which was not in conflict to some degree with potential upstream watershed projects. With regard to the other projects which conflicted with upstream watershed projects, joint studies were made by the Corps of Engineers and the Soil Conservation Service to determine which projects should be included in the 10- to 15-year plan.

(n) After a more detailed analysis and meetings with the local interests involved, three of these projects; Harviell, Fair-dealing, and Janes Creek were eliminated from the 10- to 15-year plan in favor of upstream watershed projects. Construction of these three projects would inundate agricultural areas and thereby eliminate the need for all or parts of the upstream watershed projects which also offer protection to areas upstream from the multiple-purpose projects. These three major tributary reservoir projects have been retained in the long-range plan as alternatives in the event that the upstream watershed projects do not develop as planned.

(o) The multiple-purpose dam and reservoir projects on Myatt Creek, South Fork of Spring River, and the Strawberry River were selected over a complete system of upstream watershed protection projects. The larger reservoirs were selected because they would provide benefits on their parent streams and because their large flood control capacities would allow them to withhold releases until flows on the Black River returned to within banks. Operation of the projects in this manner would result in the maximum benefit to the people in the Black River flood plain and the White River flood plain downstream from the mouth of the Black River. Even though some watershed projects were eliminated because of the major reservoirs other upstream projects are included in the 10- to 15-year plan for these three general areas.

(p) The multiple-purpose County Line Dam and Reservoir project that would be located on the James River was selected for the 10- to 15-year plan over an upstream watershed project. The upstream watershed project could not furnish a comparable amount of water supply yield or flood control benefits for the downstream area because of inability to control as much drainage area as the County Line project. Construction of the County Line project would preclude construction of the upstream watershed project in the next 10 to 15 years because the reservoir would inundate a considerable portion of the area to be protected by the upstream watershed project. The upstream watershed project has been left in the long-range plan in case the County Line project is not constructed. The multiple-purpose main stem and major tributary dam and reservoir projects in the 10- to 15-year plan are described in paragraph 22e.

(3) White River floodway.

(a) The present channel capacity of the White River downstream from Batesville, Arkansas, is only slightly in excess of the

average annual flow of 35,000 cubic feet per second. Even a modest increase in this capacity would have a significant effect in operating the existing and planned reservoirs and in control of floods in the basin. As a possible alternative for levees and reservoirs, a floodway extending from about Batesville, Arkansas, to near the mouth of the White River was considered.

(b) The floodway would be provided by land acquisition in fee title and flowage easements. It was found that if the floodway was designed to have a capacity in excess of 60,000 c.f.s. the costs for relocations of railroads and highways would be out of proportion to the additional benefits realized by the larger channel. Investigations further indicated that the 60,000 c.f.s. floodway would require acquisition of about 315,000 acres of land of which about 50 percent is cleared agricultural land. The estimated cost of acquiring land rights is in excess of $90,000,000 based on present values. The estimated average annual flood benefits that would result from the floodway were less than one-half the annual charges for the floodway. These benefits include those that would accrue to the hardwood timber industry.

(c) On the basis of the foregoing findings no further studies relating to such a floodway were made. Emphasis was then placed on protection of the flood plain by additional reduction in flood peaks by reservoir storage and by levees.

(4) Levees and channel improvements.

(a) Because of the low channel capacities of most of the Coastal Plain streams in the basin and the unavailability of storage sites in certain areas, it was necessary to consider other means of protection such as levees and channel improvements. However, attention is invited to the fact that it is important to obtain as much storage as possible to control the large flood volumes that are characteristic of the lower Black and White River floods. Confining these flows to narrow leveed channels without reducing the volume would create high water surface profiles in the channels which in turn would cause serious backwater conditions along tributaries and would increase interior drainage problems. Channel enlargement and straightening would reduce flood profiles. However, it is also costly and difficult to maintain and its effects are minor for flat gradient channels such as the lower Black and White Rivers.

(b) The additional works of improvement considered in this study had to be compatible with existing and presently planned Federal and non-Federal projects and programs. With the degree of control that could be expected with existing and potentially favorable reservoirs functioning together it was apparent that a continuous or nearly continuous levee and channel improvement system was necessary along tributaries and the main stem of the Black and White Rivers. The objective in the preliminary levee improvement investigations

was to develop a continuous system along these streams. In addition local protection improvements were investigated for Fayetteville, and Clinton, Arkansas, and Cassville, Missouri.

(c) The need for drainage improvements in smaller streams within the Coastal Plain made multiple-purpose channel improvements the most feasible solution for flood control on the same streams. For this reason, agricultural levees were not studied in the smaller alluvial watersheds.

(d) The preliminary investigations showed that nearly all of the levee and channel work studied was economically feasible. The detailed studies confirmed this finding. The Corps of Engineers projects that are in the 10- to 15-year plan are listed on Tables 26 and 27 and are described in paragraphs 22e and 22g. The Soil Conservation Service channel improvements are included in Section VI.

e. Main stem and major tributary reservoirs. Pertinent data for the Corps of Engineers main stem and major tributary reservoirs which are in the 10- to 15-year plan, except the East Fork Crooked Creek reservoir which was discussed in paragraph 7a, that have flood control as a purpose are presented in Table 26. These projects are discussed below and their locations are shown on Plate P-1.

(1) County Line Dam and Reservoir.

(a) The County Line Dam site is located about 10 miles east of the city of Springfield, Missouri, at river mile 107.8 on the James River in Webster County. The project would provide flood control, municipal and industrial water supply, water quality control, recreation, and fish and wildlife benefits. The reservoir area is shown on Plate P-2.

(b) The 144-foot high earth embankment dam would provide for a reservoir with a total capacity of 282,000 acre-feet. There would be 71,000 acre-feet of flood control storage which is equivalent to 8.7 inches of runoff from the 153 square miles of drainage area upstream from the site. This storage would afford a high degree of flood protection downstream to the vicinity of Springfield. About 75 percent of the average annual flood losses would be prevented in the 41-mile reach from the dam site to Finley Creek. The average annual flood losses that would be prevented downstream from Finley Creek would be small.

(c) The project would have 211,000 acre-feet of conservation storage. Of this total storage, 190,000 acre-feet would develop the full yield of the drainage area during the most critical drought period for the area. This volume of storage would provide 37.4 million gallons of water per day for municipal and industrial use and 27.4 m.g.d. to augment downstream flows for water quality control.

TABLE 26

PERTINENT DATA
CORPS OF ENGINEERS MAIN STEM AND MAJOR TRIBUTARY RESERVOIR PROJECTS

Item	County Line	Wolf Bayou	Myatt Creek	Wild Horse	Bell Foley
General:					
Purpose	FC,WS,WQ,R,FW	FC,P,R,FW	FC,R,FW	FC,R,FW	FC,R,FW
Stream	James River	White River	Myatt Creek	South Fork of Spring River	Strawberry River
River Mile	107.8	311.4	2.2	14.9	27.2
State	Missouri	Arkansas	Arkansas	Arkansas	Arkansas
Drainage area, sq. mi.	153	10,796	142	296	519
Dam:					
Type	Earth embankment	Conc. & earth emb.	Earth embankment	Conc. & earth emb.	Conc. & earth emb.
Spillway	Saddle	Gated	Side channel	Gated	Gated
Ht. above streambed, ft.	144	137	146	142	135
Spillway length, ft.	120	800	150	160	240
Power available:					
Installed capacity, kw.	-	180,000	-	-	-
Number of units	-	4	-	-	-
Elevation, ft. above m.s.l.:					
Top of dam	1,365	375	543	587	403
Top, flood control pool	1,343	340	515	575	390
Top, conservation pool	1,332	320	468	540	356
Pool area, acres:					
Top, flood control pool	7,020	17,300	3,350	8,540	12,450
Top, conservation pool	5,850	11,760	1,350	4,240	6,700
Storage, acre-feet:					
Flood control	71,000	289,000	106,000	217,000	318,000
Conservation	211,000	330,000	34,000	128,000	200,000
WS & WQ	(190,000)	-	-	-	-
R & FW	(1)	(1)	(34,000)	(128,000)	(200,000)
Power	-	(2)	-	-	-
Inactive	(21,000)	-	-	-	-
Total	282,000	619,000	140,000	345,000	518,000

(1) No specific storage for recreation and fish and wildlife enhancement.
(2) Wolf Bayou would be a "run-of-the-river" project with no specific storage for power and only small weekly fluctuations in the conservation pool elevation.

NOTES: FC - Flood Control; WQ - Water Quality; WS - Water Supply; P - Power; R - Recreation; FW - Fish and Wildlife Enhancement

(d) It is estimated that the conservation pool and adjacent project lands would be used to the extent of 446,000 recreation days and 125,000 man days of fishing by 1980. It is expected that the annual use of these facilities would increase as the economy of the market area grows. Facilities would be provided in the project for warm water releases to maintain the existing downstream fishery.

(2) Wolf Bayou Dam and Reservoir.

(a) The Wolf Bayou Dam site is located at river mile 311.4 on the White River about 10 miles west of Batesville, Arkansas, in Independence County. The White River enters the Coastal Plain a short distance downstream from this site and it is the furthermost downstream site on the White River at which a high or medium height dam could be constructed. At full pool the reservoir would extend upstream into Stone and Izard Counties, Arkansas, as shown on Plate 3. The project would provide flood control, hydroelectric power, recreation, and fish and wildlife benefits.

(b) The 137-foot high dam would be a concrete-gravity and earth-embankment structure with a total reservoir capacity of 619,000 acre-feet. There would be 289,000 acre-feet of flood control storage in the reservoir which is equivalent to 1.8 inches of runoff from the 2,954 square mile uncontrolled drainage area lying between the existing Bull Shoals and Norfork projects and the Wolf Bayou Dam site. The small amount of flood control storage in the reservoir would necessitate a detention-type operation which would greatly reduce peaks of floods having a frequency of up to about once in 5 years. This storage would be less effective in reducing floods of a greater magnitude. However, the project would prevent about 45 percent of the average annual flood losses along the White River in the reach from the dam site to the mouth of the Black River and about 15 percent of the losses along the White River below the mouth of the Black River.

(c) The project would have installed hydroelectric capacity of 180,000 kilowatts and a conservation pool of 330,000 acre-feet. Estimated average annual power generation at the project is 420 million kilowatt-hours. The project would operate as a run-of-the-river hydroelectric plant and would take advantage of the large power releases from upstream projects. A downstream reregulation structure would be provided to reduce the river stage fluctuation that would result from power release. The design of the reregulation structure was based on a minimum release from the Wolf Bayou project of 4,000 acre-feet per day over weekends and holidays. The project would have a relatively stable conservation pool and tailwater downstream from the reregulation structure which would have a beneficial effect on recreation and fishery use.

(d) It is estimated that the conservation pool and adjacent project lands would be used to the extent of 942,000 recreation days and 110,000 man days of fishing by 1980. Included in the estimate of 1980 man days of fishing use are 12,000 days of downstream warm-water fishing. It is expected that the annual use of these facilities would increase as the economy of the market area grows. Provision would be made in the dam to release the warmest water in the reservoir through the turbines. This would result in a benefit to the downstream warm-water fishery.

(e) The full potential of the site would not be developed with a dam having a height of 137 feet. In formulating a project for the site the following constraints were recognized.

1. With the construction of Bull Shoals and Norfork projects and the resulting cold-water releases, a valuable trout fishery has been developed in the White River below these projects. Trout fishing and the resulting service industries are of major economic importance to the area. The trout fishery extends downstream to the vicinity of the Wolf Bayou site but it is considered only fair below the town of Calico Rock which is near the upstream limit of the conservation pool. Fishery interests have not objected to the project formulated in this study.

2. Chemical-grade limestone quarries are located in the bluffs adjacent to the White River about midway between the dam site and Calico Rock. A large silica sand-mining operation is located at Guion. Maximum reservoir development would require extensive and expensive relocation of facilities for these mining operations. However, the project formulated in this study will allow operations to continue with minor relocation of facilities. They would continue to be served by the Missouri Pacific Railroad with minor relocation of spur tracks.

3. The portion of the Missouri Pacific Railroad which follows the White River from Batesville to Calico Rock, Arkansas, would be affected by project construction. Relocation outside the valley would preclude the railroad from servicing the chemical-grade limestone and silica sand industries. Relocation outside the valley with provision for servicing traffic points in the valley would be more costly than a relocation within the valley. Constructing the roadbed at higher elevations in the valley along the many vertical rock cliffs would be difficult and expensive. By cut and fill construction the railroad can be relocated in the valley with no major disruption in traffic or increase in grade at a feasible cost for the project formulated in this study.

4. Three State highways, a few county roads, and the towns of Calico Rock and Guion would be affected by development of

a project to the maximum physical height at the Wolf Bayou site. For the project formulated in this study, Calico Rock and the State highways would be unaffected, the town of Guion could be economically protected by levees, and county road relocation requirements would be relatively minor.

(f) The project would be designed so that the capacity of the flood control pool could be increased if some of the constraints which limit the height of the dam are removed in the future. Because of the magnitude of the spillway design flood and the site topography, the project would be designed with a considerable amount of freeboard above the top of the flood control pool.

(3) Myatt Creek Dam and Reservoir.

(a) The Myatt Creek Dam site is located at river mile 2.2 on Myatt Creek in Fulton County, Arkansas, about 5.0 miles northwest of Hardy. The reservoir area is shown on Plate P-4. The project would provide flood control, recreation, and fish and wildlife benefits.

(b) The 146-foot high earth embankment dam would provide for a reservoir with a total capacity of 140,000 acre-feet. There would be 106,000 acre-feet of flood control storage which is equivalent to 14 inches of runoff from the 142 square miles of drainage area upstream from the site. This comparatively large flood control storage is needed to provide long-period holding capacity to reduce flooding on the downstream Spring and Black Rivers where flood control storage is at a minimum. The project would reduce average annual flood loss by 8, 5, and 3 percent, respectively, on the Spring, Black, and White Rivers.

(c) It is estimated that the conservation pool and adjacent project lands would be used to the extent of 108,000 recreation days and 23,000 man days of fishing by 1980. It is expected that the annual use of these facilities would increase as the economy of the market area grows. Facilities would be provided in the project for cold-water releases to maintain the downstream Spring River cold-water fishery which presently extends to the mouth of the South Fork of Spring River.

(4) Wild Horse Dam and Reservoir.

(a) The Wild Horse Dam site is located at river mile 14.9 on the South Fork of the Spring River in Fulton County, Arkansas, about 7 miles west of Hardy. The reservoir map is shown on Plate P-5. The project would provide flood control, recreation, and fish and wildlife benefits.

(b) The 142-foot high concrete-gravity and earth embankment dam would provide a reservoir with a total reservoir capacity of 345,000 acre-feet. There would be 217,000 acre-feet of flood control capacity which is equivalent to 13.7 inches of runoff over the 296 square-mile drainage area upstream from the site. Like the Myatt Creek Dam and Reservoir, this amount of storage would be sufficient and necessary to store flood runoff until floodwaters on the downstream Spring

and Black Rivers recede. The project would reduce average annual damages on the Spring, Black, and White Rivers by 15, 9, and 5 percent, respectively.

(c) It is estimated that the conservation pool and adjacent project lands would be used to the extent of 340,000 recreation days and 85,000 man days of fishing by 1980. It is expected that the annual use of these facilities will increase as the economy of the market area grows. Facilities would be provided for a warm-water release to maintain the existing warm-water fishery on the Spring River downstream from the mouth of the South Fork.

(5) Bell Foley Dam and Reservoir.

(a) The Bell Foley Dam site is located at river mile 27.2 on the Strawberry River in Sharp County, Arkansas, about 15 miles west of Powhatan. The reservoir area is shown on Plate P-6. The present dam site is in the same general location as the authorized Bell Foley project discussed in Section II. The project would provide flood control, recreation, and fish and wildlife benefits.

(b) The 136-foot high concrete-gravity and earth embankment dam would provide for a reservoir with a total capacity of 518,000 acre-feet of which 318,000 acre-feet would be for flood control. This is equivalent to 11.5 inches of runoff over the 519 square mile drainage area upstream from the dam site. The project, with its large holding capacity, is particularly important for flood prevention along the Black River downstream from the mouth of the Strawberry River. It is also a key project along with Wolf Bayou in helping to reduce the frequent flooding on the lower White which originates from uncontrolled runoff areas downstream from the existing projects. The project would reduce average annual flood losses on the Strawberry, Black, and White Rivers by 27, 20, and 8 percent, respectively.

(c) It is estimated that the conservation pool and adjacent project lands would be used to the extent of 537,000 recreation days and 121,000 man days of fishing by 1980. It is expected that the annual use of these facilities would increase as the economy of the market area grows. A warm-water release for the downstream warm-water fishery would be provided.

f. Description of main stem and major tributary reservoirs in the long-range plan.

(1) Grandview Dam and Reservoir. The Grandview Dam site is located on the Kings River at river mile 34.6, about 5 miles northwest of Berryville, Carroll County, Arkansas. The project as studied would provide for hydroelectric power and recreation. The project was studied for a power installation of 18,000 kilowatts. Additional data on the

power investigations are given in paragraph 24e(2)(b). The project is considered as an alternative for long-range development if the stream is not included in the preservation program of the State of Arkansas.

(2) Kinser Bridge Dam and Reservoir. The Kinser Bridge Dam site is located on the James River at river mile 96.7 about 3 miles southeast of Springfield in Greene County, Missouri. The project was studied for flood control, water supply, recreation, water quality control, and fish and wildlife enhancement. A 95-foot high structure would control the runoff from an area of 245 square miles and have a total storage capacity of 136,000 acre-feet. The project was included in the long-range plan as a possible source of additional water supply for the area in the future.

(3) Finley Creek Dam and Reservoir. The Finley Creek Dam site is located at Finley Creek mile 19 about 5 miles east of Ozark in Christian County, Missouri. The project studied would provide flood control and recreation benefits. A 131-foot high structure would provide a total storage capacity of 110,000 acre-feet of which 60,000 acre-feet would be for flood control. This is equivalent to 6.6 inches of runoff from the 163 square miles of upstream drainage area. A conservation pool of about 50,000 acre-feet would have a surface area of 1,725 acres. The project is in the long-range plan and is an alternate for an upstream watershed program of the Soil Conservation Service that is also in the long-range plan.

(4) Galena Dam and Reservoir. The Galena Dam site is located on the James River at river mile 50.2 about 15 miles upstream from Table Rock Lake and about 3 miles north of Galena in Stone County, Missouri. The project was considered for flood control, hydroelectric power, and recreational purposes. The project studied was a 164-foot high concrete gravity structure which would control the runoff from an area of 959 square miles. The storage capacity of the reservoir would be 846,000 acre-feet of which about 260,000 acre-feet (15.5-foot drawdown) was considered for power generation. The flood control increment was found to be unfeasible and this feature was eliminated and then the project was studied for power and recreation only. This project would have a hydroelectric capacity of 144,000 kilowatts of which there would be one 48,000-kilowatt conventional unit and two 48,000-kilowatt reversible units. This project was included in the long-range plan as an alternate for the State of Missouri plan for preserving this reach of the James River in the next 10 to 15 years.

(5) Crooked Creek Dam and Reservoir. The Crooked Creek Dam site is located on Crooked Creek at about mile 26, upstream from Yellville in Marion County, Arkansas. The project was studied for flood control, water supply, and recreation. The drainage area above the site is about 354 square miles. The site has a potential storage of about 250,000 acre-feet which would provide storage for approximately 11 inches of runoff from the drainage area. The project is included in the long-range plan as an alternate for an upstream watershed project that is also in the long-range plan.

(6) Piney Creek Dam and Reservoir. The Piney Creek Dam site is located at Piney Creek mile 2.0 immediately downstream from the mouth of Mill Creek. The mouth of Piney Creek is at about mile 352 on the White River. The project was studied for flood control, water supply, and recreation. A dam about 125 feet in height at this location would provide a total storage capacity of about 210,000 acre-feet. This is equivalent to about 10 inches of runoff from the drainage area of 173 square miles. This project is included in the long-range plan as an alternate for an upstream watershed project that is also in the long-range plan.

(7) Polk Bayou Dam and Reservoir. The Polk Bayou Dam site is located on Polk Bayou at mile 5.0, about 4 miles north of Batesville, Arkansas. The project was studied for flood control, water supply, and recreation. The site has a potential storage of about 80,000 acre-feet which would provide storage for about 14 inches of runoff from the drainage area of about 118 square miles.

(8) Harviell Dam and Reservoir. The Harviell Dam site is located on Cane Creek at mile 17.6 in Butler County about 7 miles southwest of Poplar Bluff, Missouri. The project was studied for flood control and recreational purposes. A 62-foot high dam would provide a total storage capacity of 54,000 acre-feet of which 41,800 acre-feet would be for flood control. This is equivalent to 4.3 inches of runoff from the 170 square miles of drainage area upstream from the site. The project would provide varying degrees of protection to 81,000 acres of agricultural land and improvements along the lower 17.6 miles of Cane Creek and along the Black River downstream from the mouth of Cane Creek. The project is considered as an alternative for long-range consideration in case the Soil Conservation Service upstream watershed project is not constructed.

(9) Fairdealing Dam and Reservoir. The Fairdealing Dam site is located at mile 37.4 on the Little Black River, in Butler County, about 10 miles southwest of Poplar Bluff, Missouri. The project was studied for flood control and recreation. A 75-foot high dam would provide a total storage capacity of about 77,000 acre-feet of which 47,400 acre-feet would be for flood control. This is equivalent to about 4.9 inches of runoff from the 182 square miles of drainage area upstream from the site. The project would provide varying degrees of protection to about 108,300 acres of highly developed agricultural land along the lower 37.4 miles of the Little Black River, and along the lower 28 miles of the Current River. The project is included as an alternative to be included in the long-range plan in case the Soil Conservation Service upstream watershed project is not constructed.

(10) Doniphan Detention Structure. The Doniphan Detention Structure site is located on the Current River at river mile 55.0. The project would provide flood control benefits by reducing flood peaks and velocities. The structure would consist of a low uncontrolled weir

across the streambed set low enough not to interfere with boating. The weir crest length of 70 feet would be approximately the width of the present channel. Non-overflow sections would be on either side of the weir and extend to high ground. There would be no permanent pool formed, as the purpose of the project would be to delay high flows only.

(11) Janes Creek Dam and Reservoir. The Janes Creek Dam site is located at mile 9.2 on Janes Creek about 3 miles south of Ravenden Springs in Randolph County, Arkansas. The project was studied for flood control and recreation benefits. A 100-foot earth embankment dam would provide a total storage capacity of 107,000 acre-feet which is equivalent to 6.9 inches of runoff from the 82 square miles of drainage area upstream from the site. The project would provide varying degrees of protection to about 752,100 acres of fertile alluvial valley land along the lower 9 miles of Janes Creek, the lower 18 miles of the Spring River, and to a lesser degree to the lower 70 miles of the Black River. The project is included as an alternative to be included in the long-range plan in case the Soil Conservation Service upstream watershed project is not constructed.

g. Description of levee and channel improvement projects in the 10- to 15-year plan. The Corps of Engineers projects in the 10- to 15-year plan include 12 levee projects for local flood protection and one major outlet for flood control and agricultural water management. These projects would be in the Mississippi Alluvial Plain along the Black River and tributaries downstream from Poplar Bluff, Missouri, and along the lower White River and tributaries downstream from Oil Trough, Arkansas. Names and pertinent data relating to these projects are shown on Table 27. The projects are discussed in the following paragraphs.

(1) Black River-Cane Creek, Butler County, Missouri. The Black River-Cane Creek local protection project would consist of levees extending along the Black River from Poplar Bluff, Missouri, downstream to a point about 8 miles below the confluence of Cane Creek, and levees and channel improvements along the lower 13 miles of Cane Creek. The project would protect about 75,000 acres of overflow from Black River-Cane Creek, and a short portion of Pike Creek near Poplar Bluff. A part of the southern portion of Poplar Bluff would be protected by this levee. The levee grade that protects this part of Poplar Bluff would be based on Standard Project Flood design. The remaining part of the levee would be designed for protection against a flood with an average frequency of once in 50 years. The plan and profile for the project are shown on Plate P-7.

(2) Little Black River, Butler and Ripley Counties, Missouri; Clay and Randolph Counties, Arkansas. The Little Black River Levee would be about 21.1 miles in length, extending along the left bank of the Little Black River from a point near its confluence with the Current River upstream to about mile 32 on the Little Black River. The levee would protect about 37,500 acres from flooding by both the Little Black and Current Rivers. The average height of the levee would be about 13.4

TABLE 27

PERTINENT DATA
CORPS OF ENGINEERS LEVEE AND CHANNEL IMPROVEMENT PROJECTS

Name	Location: Stream	Location: Mile	Length of improvement (Miles)	Average height of levee (Feet)	Area benefited (Acres)
Black River-Cane Creek, Butler Co. Mo., and Clay Co., Ark.	Black River Cane Creek	158-211 3-18	62.8	13.4	75,000
Little Black River, Butler and Ripley Cos., Mo., and Clay and Randolph Cos., Ark.	Little Black River	0-32	21.4	13.4	37,500
Current-Little Black Rivers, Ripley Co., Mo., and Clay Co., Ark.	Current River Little Black River	28-35 1-15	14.3	14.6	5,800
Black-Current-Fourche Rivers, Randolph Co., Ark.	Current River Black River Fourche River	0-28 93-96 0-6	30.7	12.7	20,400
Flat Creek, Lawrence Co., Ark.	Black River	51-66	15.2	12.5	6,000
Clover Bend, Lawrence, Jackson, and Independence Cos., Ark.	Black River Big Running Water Creek	25-54 0-14	33.1	14.7	17,000
Black-Strawberry Rivers, Lawrence and Independence Cos., Ark.	Strawberry River Black River Curia Creek Ditch	0-9 33-44 0-3	14.1	15.5	9,000
Curia Creek, Independence Co., Ark.	Black River Dota Creek Curia Creek Ditch	7-33 0-2 0-3	20.8	20.3	20,700
Oil Trough to Hurricane Lake, Independence, Jackson, and White Cos., Ark.	White River	199-282	45.1	17.4	55,000
Jacksonport, Jackson Co., Ark.	White River Black River	258-265 0-1	6.0	21.9	2,400
Taylor Bay to Augusta, Woodruff Co., Ark.	White River	203-232	15.9	19.2	19,300
Little Red-White Rivers, White and Prairie Cos., Ark.	Little Red River White River Raft Creek	0-15 164-182 0-15	33.3	19.5	29,000
Bayou Des Arc, White and Prairie Cos., Ark.	Bayou Des Arc	4-22	13.0	-	(1)36,000

(1) Major outlet for Soil Conservation Service Watershed Nos. 103, 104, and 105.

feet and would be designed to protect against a flood with an average frequency of once in 50 years. The plan and profile for the project are shown on Plate P-8.

(3) Current-Little Black Rivers, Ripley County, Missouri, Clay County, Arkansas. The Current-Little Black River Levee would be located along the left bank of the Current River between miles 28 and 35 and along the right bank of the lower 15 miles of the Little Black River. The levee would be about 14.3 miles in length and would protect about 5,800 acres of agricultural land from overflow from both the Current and Little Black Rivers. The average height of the levee would be about 14.6 feet and would protect the area against a flood with an average frequency of about once in 50 years. Plate P-9 shows the plan and profile for the project.

(4) Black-Current-Fourche Rivers, Randolph County, Arkansas. The Black-Current-Fourche River Levee would be located along the right bank of the lower 28 miles of the Current River, northeast of Pocahontas in Clay and Randolph Counties, Arkansas, and would protect about 20,400 acres. The levee would tie to high ground on the right bank of the Current River about opposite the mouth of the Little Black River and extend along the Current River to its confluence with the Black River; then follow the right bank of the Black River for about 2 miles to near the point where the Fourche River enters the Black River; then follow the left bank of the Fourche River and Lateral Ditch No. 5 to high ground near the point of origin. The total length of the levee would be about 30.7 miles and its average height would be about 12.7 feet. It would provide protection against a flood with an average frequency of about once in 50 years. The plan and profile for this project are shown on Plate P-10.

(5) Flat Creek, Lawrence County, Arkansas. The Flat Creek Levee would extend along the right bank of the Black River downstream from mile 66 just south of Powhatan, Arkansas, to near the old mouth of Cypress Creek about Black River mile 51, thence west along the north edge of Shirey Bay-Rainey Brake Wildlife Management Area, thence northeastward along the Ozark Escarpment to tie into high ground about 1 mile southwest of the point of beginning of the levee. The part of the levee along the escarpment and an intercepting ditch along its outside toe would divert flows from Flat Creek, Cow Creek, and smaller escarpment tributaries into Cypress Creek which enters the Black River downstream from the project. The levee would be about 15.2 miles long and have an average height of about 12.5 feet. It would protect about 6,000 acres of agricultural land against a flood with an average frequency of about once in 50 years. The plan and profile of the project are shown on Plate P-11.

(6) Clover Bend, Jackson and Lawrence Counties, Arkansas.

(a) The Clover Bend Levee would begin at high ground near river mile 54 on the Black River and extend downstream along the left bank of the Black River to the mouth of Big Running Water Ditch, mile 25.

It would then follow upstream along Big Running Water Creek to a point near the upstream starting point for the levee. The levee would provide protection to about 17,000 acres of agricultural land located between the Black River and Big Running Water Ditch.

(b) Flooding of the area usually results from the Black River overflow and backwater, although some flooding is experienced from Big Running Water Creek after local storms. The levee grade on the Black River and upper Big Running Water Creek would be based on a flood with an average frequency of about once in 50 years, but the grade on Big Running Creek near the mouth would be based on backwater from the 50-year flood. The average height of the levee would be 14.7 feet. A plan and profile for the levee are shown on Plate P-12.

(c) The outlets through the levee would be coordinated with the plans for drainage of the area and for improvement of Big Running Water Creek Channel now under way by the Department of Agriculture. The portion of the levee through the Shirey Bay Public Hunting Area would be coordinated with the Arkansas State Fish & Game Commission, who have already made their desires known in respect to mitigation measures. A small pumping station would be installed in the levee in this area that will permit pumping both into and from the Black River. The culverts through the levee in this area would be larger than ordinary to facilitate flow both into and from the river as desired for wildlife purposes.

(7) Black-Strawberry Rivers, Lawrence and Independence Counties, Arkansas. The Black-Strawberry Rivers project would consist of both a levee and diversion channel for the Strawberry River. The levee would begin at a point on the right bank of the Strawberry River at about mile 9 and extend downstream about 1 mile, thence cross the river and extend eastward around the south boundary of Shirey Bay-Rainey Brake Wildlife Management Area to the right bank of the Black River at about mile 44, thence along the Black River downstream crossing the mouth of the Strawberry River and extending to a point opposite about mile 33 near the mouth of Curia Creek, thence westward along the left bank of Curia Creek to tie into the Ozark Escarpment. The Strawberry River diversion channel would begin at about mile 8 on the river and extend along the north side of the levee to enter the Black River at about mile 44. Construction of the diversion channel and therefore the whole project would depend upon prior development of the Bell Foley Dam and Reservoir project. The Bell Foley project and Soil Conservation Service Cooper Creek Reservoir project would control about 600 square miles of the 800 square mile drainage area. This control would reduce flood flows in the Strawberry River and thus reduce the size of the diversion channel to within economic limits. The total length of the diversion channel would be about 4.5 miles. The levee would be about 14.1 miles long and have an average height of about 15.5 feet. The project would protect about 9,000 acres of rich alluvial agricultural land against a flood on the Black River with an average frequency of about once in 50 years.

Provisions would be made to allow flooding of the old Strawberry River channel to maintain its fishery. The plan and profile of the project are shown on Plate P-13.

(8) Curia Creek, Independence County, Arkansas.

(a) The Curia Creek Levee would protect about 20,700 acres of agricultural land along the Black River and be about 20.8 miles in length. It would begin at the edge of the Ozark escarpment opposite about mile 33 on the Black River and extend downstream along the right bank of Curia Creek to about the mouth of that stream and then along the right bank of the Black River to the mouth of Dota Creek. It would then follow the left bank of Dota Creek back to high land near the escarpment.

(b) The grade of the levee would be based on a flood on the Black River with an average frequency of about once in 50 years. The average height of the levee is about 20.3 feet. Plate P-14 shows a plan and profile for the levee.

(9) Jacksonport, Jackson County, Arkansas. The Jacksonport Levee project would protect about 2,400 acres of agricultural land and the village of Jacksonport, Arkansas, with a population of about 300 against floods from the Black and White Rivers. Jacksonport is a historical site and is part of the Arkansas State Park system. The levee would replace an existing local-interest levee that is deficient in both grade and section. The levee would begin at the Newport Levee which was constructed by the Corps of Engineers, and generally follow the alignment of the present levee along the left bank of the White River past Jacksonport to near the mouth of the Black River. It would then follow the left bank of the Black River for a short distance and tie into high ground about 2 miles north of Jacksonport. Because the levee would protect an urban and historical area, the grade of the levee would be designed to provide protection against the Standard Project Flood. The present drainage pattern is expected to be retained within the leveed area, and no change is expected in the location of culverts. Plate P-16 shows the plan and profile for the project.

(10) Oil Trough to Hurricane Lake, Independence, Jackson, and White Counties, Arkansas.

(a) The Oil Trough to Hurricane Lake (Departee Creek) Levee would protect about 55,000 acres of agricultural land along the White River between river mile 282 and 199. The length of the levee would be about 45 miles and the average height would be about 17.4 feet. The levee would generally follow the right bank of the White River from high ground near Oil Trough, Arkansas, to near Hurricane Lake near the mouth of the Little Red River. This would be an open-end levee and would extend several miles into the Hurricane Lake Wildlife Area owned by the Arkansas State Fish and Game Commission.

(b) The land that would be protected by the levee is flooded by the White River. In addition, some of the land is flooded by Departee Creek. Under present conditions during large floods, the White River breaks over low areas near Oil Trough, Arkansas, and continues overland to the mouth of the Little Red River. Other flooding reaches the area first by backing through sloughs before general overbank flow commences.

(c) The levee would provide protection against a flood with an average frequency of about once in 30 years. Although the objective of the study was to provide 50-year protection, the costs of altering existing improvements outside of the leveed area resulted in an optimum economic project at the 30-year level. The plan and profile for the project are shown on Plate P-15.

(d) The Soil Conservation Service has studied this area and has developed an economical plan for reducing flooding from Departee Creek and improving drainage that is both compatible and complementary to the levee project. The Soil Conservation Service plan would include improvement of the Departee Creek Channel to the point where it would cross the levee alignment. The levee plan includes a major outlet structure at that location plus an extended landside ditch along the lower portion of the levee to carry Departee Creek flow to the White River backwater area when the floodgates in the outlet would be closed.

(e) Another feature that would be included as a mitigation measure at the request of the Fish and Game Commission is a structure in the extended landside ditch to control low flows from Departee Creek when desired. In addition, flow from the White River could be diverted through the major outlet structure and down the extended landside ditch if desired.

(11) Taylor Bay to Augusta, Woodruff County, Arkansas.

(a) The Taylor Bay to Augusta Levee would provide protection to about 19,300 acres of agricultural land that is flooded by the White River that is generally located between the river and Taylor Bay. The levee would begin at Village Creek, White River and Mayberry Districts Levee, that was constructed by the Corps of Engineers, and extend down the left bank of the White River, cross Taylor Bay near its mouth, and tie into high ground just north of Augusta, Arkansas. A 300,000 g.p.m. pumping station would be included in this project at Taylor Bay.

(b) The grade of this levee would be based on a flood with an average frequency of about once in 30 years. A 50-year flood level of protection was desired, but additional costs for altering existing improvements outside the levee showed the 30-year protection to be the most economical. The plan and profile for the project are shown on Plate P-17.

(12) Little Red-White Rivers, White and Prairie Counties, Arkansas.

(a) The Little Red-White River Levee would protect about 29,000 acres of agricultural land from flooding by the Little Red and White Rivers and Raft Creek. The levee would begin at high ground at about mile 15 on the right bank of the Little Red River and follow the alignment of the existing Little Red River Levee District No. 1 levee. It would continue past the end of the existing levee to near the mouth of the Little Red River. From that point it would follow near the right bank of the White River to near the mouth of Raft Creek. The levee would follow along the left bank of Raft Creek to high ground near the point of origin of the levee.

(b) The existing levee along the Little Red River provides protection against high velocity overbank flow that cuts across the area from the Little Red River to the White River. However, backwater from the White River and flows from Raft Creek inundate much of the area.

(c) The grade of the new levee would provide protection against a flood with an average frequency of about once in 30 years. This level of protection resulted in the greatest excess benefits because a higher level of protection would require a large increase in costs for modifying existing improvements outside the protected area. Outlets through the levee will be coordinated with the drainage required for drainage of the protected area. Plate P-18 shows a plan and profile for the project.

(13) Bayou Des Arc, Prairie and White Counties, Arkansas. The Bayou Des Arc Project would be a major drainage outlet for three upstream watershed projects. The outlet would be necessary to allow these three watershed projects to function as they would be designed. The project would consist of enlargement and realignment of Bayou Des Arc for about 13 miles between miles 4 and 22. The improved channel would discharge a once-in-2-year flood without overflow during low stages on the White River. The improved channel would not benefit adjacent land appreciably because of frequent overflow, but it would provide sufficient capacity to drain the upstream watersheds. It is economically justified by the increased benefits that would accrue to these watersheds. Plate P-19 shows the location and plan for the project.

h. Description of levees and channel improvements in the long-range plan.

(1) Fayetteville Levee, Washington County, Arkansas.

(a) The city of Fayetteville, Arkansas, owns about 450 acres of land at and adjacent to the city airport of which about 200 acres are subject to periodic flooding. The city officials have

indicated that the present airport may be abandoned in the future and a new airport built northwest of the city. If this is done the city is planning to develop the present airport area and possibly some adjacent lands into an ind strial complex.

(b) Should this change take place flood protection would be a necessity. The Soil Conservation Service has planned an upstream watershed project for protection of agricultural lands which would provide some protection to the area. To provide adequate protection a levee ranging from 5 to 6 feet in height and possibly 2 to 3 miles in length would be required in addition to the watershed project.

(2) Flat Creek, Cassville, Missouri. The town of Cassville, Missouri, is subject to overflow from Flat Creek and several small tributary streams within the town. Preliminary studies indicate that flood control improvements needed include about 1.5 miles of channel work along the main channel of Flat Creek, some channel work on tributary streams, and alteration of a State highway bridge, a street bridge, and several culverts. The best plan for protection of the town would be a combination of these channel works and upstream reservoirs. The Soil Conservation Service studied a system of floodwater retarding structures that would be located upstream from the town, but due to lack of control of an adequate portion of the drainage area, it was concluded that the channel work in Cassville would still be required. Because of the required alterations necessary on the highway and street bridge, the non-Federal share of costs would be high. The Town Council of Cassville has given no indication that the town can meet the necessary local requirements.

(3) Big Bottom, Independence County, Arkansas. The Big Bottom project would consist of a levee along the right bank of the lower 5 miles of Dota Creek, the right bank of the Black River from the mouth of Dota Creek to its confluence of the Black River with the White River at mile 266 and along the left bank of the White River to a point opposite mile 285. The project would provide protection to about 18,000 acres of rich alluvial land against flooding from Dota Creek and the Black and White Rivers. The plan considered would provide for the construction of about 22.2 miles of new levee with an average height of 8.5 feet.

(4) Clinton, Van Buren County, Arkansas. A portion of the town of Clinton, Arkansas, is subject to overflow from the Archey Fork of the Little Red River. The plan considered for protection of the town would provide for construction of a right bank levee about 1 mile in length. About 4 drainage structures would be required in addition to some minor relocations.

(5) Clarendon to Laconia Circle, Monroe and Phillips Counties, Arkansas. This project was authorized by the Flood Control Act of 1936. This authorization provides for the construction of a levee about 48.5 miles long that would run south from Clarendon toward Laconia Circle.

The levee would protect approximately 287,000 acres of the adjacent flood plain against overflow from the White River headwater and the Mississippi River backwater. The need for this project below Big Creek has been reduced by construction of the White River Reservoirs, the White River Backwater Levee, the Graham Burke Pumping Station, and cut-offs on the Mississippi River.

23. OUTDOOR RECREATION AND FISH AND WILDLIFE

a. Objective. The White River Basin provides outstanding opportunities for outdoor recreation and sport fishing and hunting. The need for such opportunities is rapidly growing throughout the Nation as a result of the expanding population, increases in income, and the changes in the natural environment. Many of the streams and related lands of the basin are almost naturally unique. One of the objectives in planning was to preserve and enhance as much of these resources as possible within the framework of overall prudent development of the water and related land resources of the basin. Examples of very important recreation and fish and wildlife resources are the clear free-flowing streams and areas of outstanding natural beauty in the Ozarks Plateaus, and the bottom-land hardwood forests in the Coastal Plain portion of the basin. Further, the outdoor recreation and fish and wildlife potential of other developments that would be primarily for other purposes was recognized and given full consideration. The overall goal was to develop a diversified outdoor recreation and fish and wildlife plan by taking advantage of the potentials of other proposals and preserving, protecting, and enhancing the outstanding natural water and related land resources of the basin. In doing this the demand upon the resources for other purposes was recognized and it was attempted to maintain harmony between all purposes and develop the resources in a manner that would be of greatest benefit to the people of the basin, the recreation demand area, and the Nation. Full development of all the potential outdoor recreation and fish and wildlife resources of the basin cannot meet the ever-increasing demand for such resources. Therefore, in a true sense, there are no alternative solutions within the basin for meeting the outdoor recreation and fish and wildlife needs.

b. 10- to 15-Year plan of development.

(1) National Scenic Rivers. In addition to the existing and proposed national scenic rivers administered by the National Park Service, the plan includes 20 miles of the Current River from the downstream limit of the Ozark National Scenic Riverways to the southern boundary of the Mark Twain National Forest. This would provide almost complete preservation of the Current River in Missouri. Adjacent lands would be acquired in fee or by scenic easements in order to preserve and develop the natural environment for scenic values, float fishing, hunting, and other types of outdoor recreation use.

(2) Stream preservation. The unique value of clear free-flowing Ozark-type streams is recognized. Preservation of segments of

9 such streams in Missouri and 10 in Arkansas is included in the plan. Preservation would be accomplished by acquisition of minimum acreage of adjacent lands in fee or by scenic easements. Fee acquisition would be primarily at access points. Certain segments of the streams would be developed for intensive use while others would be left alone to exemplify a primitive environment. The streams shown in Table 28 would serve both recreation and fish and wildlife purposes.

TABLE 28

STREAM PRESERVATION

Stream	Water (miles)	Land (acres)	Access sites (No.)
Federal, in National Forests			
Missouri:			
North Fork	30	4,800	4
Beaver Creek	37	5,900	4
Little North Fork River	20	3,200	3
Roaring River	5	800	1
State			
James River	26	4,420	5
Upper Black River	34	5,400	4
Bryant Creek	36	5,800	4
Bull Creek	10	1,600	2
Swan Creek	13	2,100	2
Arkansas:			
Kings River	40	6,400	5
War Eagle Creek	30	4,800	3
Spring River	25	4,000	3
Bear Creek	20	3,200	2
Archey Fork of Little Red River	32	5,120	4
Middle Fork of Little Red River	40	6,400	5
North Sylamore Creek	14	2,240	2
Big Creek above Bell Foley Reservoir	18	2,880	2
Richland Creek	24	3,840	3
Salado Creek	26	4,160	3

(3) Large impoundments

(a) The 5 main stem and major tributary multiple-purpose reservoirs and the Quarry regulation project in the plan would provide facilities for both outdoor recreation and fish and wildlife purposes. A surface area of 30,900 acres would be provided by the conservation pools when they are full. These reservoirs would enhance the distribution of warm-water fishery and trout habitat in the basin.

Outlet structures at Wolf Bayou, County Line, Wild Horse, and Bell Foley would be designed to release the warmest water in the reservoirs to complement the warm-water fishery downstream. The outlet structures at Myatt Creek and Quarry would be designed to release the colder water to sustain and possibly enhance and extend existing downstream trout habitat. Development of 30 recreational and access areas, comprising about 12,000 acres, would provide considerable increases in outdoor recreational and fish and wildlife opportunities. Some of these areas are downstream from the dams.

(b) All of the main stem and major tributary projects except the Quarry project are for multiple-purpose development and are described more fully in paragraph 22e. The Quarry site is located at mile 64.3 on the Little Red River in Cleburne County, Arkansas, about 4 miles east of Heber Springs and about 15 miles downstream from the existing Greers Ferry Dam and Reservoir project. The structure would consist of a 300-foot uncontrolled concrete spillway section about 60 feet in height above the streambed, earth embankment sections on each side of the spillway, and 2 gated conduits to maintain downstream flow at all times. The principal project purposes would be to reregulate the flows from the hydroelectric power generation at the existing Greers Ferry project to enhance the downstream trout fishery and other recreational activities downstream from Greers Ferry. The project would extend the present trout fishery about 25 miles farther downstream to the vicinity of Searcy, Arkansas. The project would also create a cold-water fishery reservoir with an average pool area of about 1,000 acres. The reservoir would have other limited recreational uses.

(4) Small impoundments.

(a) The Soil Conservation Service multiple-purpose impoundments included in the plan would provide 20,581 acres of water surface for recreation and fish and wildlife uses. Of this total 15,287 acres would be the sediment pools, 946 acres would be the municipal and industrial water supply pools, 245 acres would be the water quality control pools, 634 acres would be the irrigation pools, and the acres in the various pools specifically for recreation and fish and wildlife would be 2,829 and 640, respectively. In addition, there would be other Soil Conservation Service single-purpose impoundments that would provide 920 acres of water surface for recreational uses. Of this total 880 acres would be in Watershed Numbers 22, 35, 36, 47, 38, 57, and 77 specifically for recreation, and 40 acres would be a municipal and industrial water supply pool in Watershed Number 9. If full utilization of these small impoundments is achieved, adequate access and public use facilities must be developed.

(b) The States of Arkansas and Missouri propose 9 lakes in the plan. These would have a combined surface area of about 3,000 acres and would be used primarily for fishing.

(c) The small impoundments would alleviate local needs for lake fishing in the southern part of Missouri and northeastern Arkansas.

(5) Stream access. More than 100 stream access sites are proposed for the streams included in the 10- to 15-year plan for national scenic rivers, stream preservation, and numerous other streams. Some sites would be developed for intensive use while others would provide for only limited use in order to preserve natural environmental conditions. The access sites were predicated on the basis that there should be at least one site for each 10 to 15 miles of stream.

(6) Land acquisition.

(a) The 10- to 15-year plan includes a proposal to increase land holdings in the Mark Twain, Clark, and Ozark-St. Francis National Forests. Primarily, this would involve consolidation of holdings within proclamation boundaries and acquisition of marginal lands along selected streams, scenic environmental areas, and areas to provide for public use. There are seven areas of special scenic, geological, and botanical interest included in the acquisition plan. They are Blanchard Springs Caverns, Piney Creek Scenic Area, Peckout Hollow Outdoor Lab, Glades Scenic Area, Panther Springs Geologic Area, Tupelo Gum Pond Botanical Area, and the Irish Wilderness. The location of these special areas is shown on Figure 5, Appendix J. The area to be acquired included in the plan is about 300,000 acres in Missouri, and 73,000 acres in Arkansas. Principal developments would be swimming, camping, picnic facilities, and hiking trails.

(b) The plan includes the acquisition of 4,000 acres adjacent to the White River National Wildlife Refuge by the Federal Government, to be used chiefly for providing winter feeding habitat for Canada geese.

(c) The Arkansas Game and Fish Commission has included in the plan the acquisition of 24,000 acres of bottom-land hardwood areas in the lower reaches of the White River Basin by the State. These areas are needed to reserve some of the highly productive wildlife habitat being rapidly lost to farm production.

(7) Other recreation and fish and wildlife features. Other outdoor recreation and fish and wildlife features included in the plan are as follows:

(a) The expansion of the Montauk State Fish Hatchery in Missouri to increase production from 96,000 to 150,000 pounds of trout per year.

(b) Private water development projects including 5,400 and 1,300 acres of farm ponds in Arkansas and Missouri, respectively; 1,380 acres of municipal and industrial water supply lakes; fee-fishing lakes; and access and other commercial facilities.

(c) A national recreation area for the Beaver, Table Rock, Bull Shoals, and Norfork reservoir complex.

These reservoirs and associated areas attract millions of visitors from throughout the Nation annually. The natural beauty of the area together with such a large amount of water for recreational area use and its national popularity make it ideal for a national recreational area. This feature of the plan should be given further consideration by a separate study.

(d) Eight scenic drives that would be in the national forests, except Arkansas State Highway 7 south from Harrison, Arkansas, to the basin boundary. These would make some of the most outstanding scenic values of the basin accessible to the public.

(e) Three hiking and saddle trails in the Mark Twain National Forest.

(f) Ozark Scenic Railway from the southern basin boundary near Cabot, Arkansas, to Newport, thence generally along the White River to Branson, Missouri, and thence northward to Springfield, Missouri. This existing railroad would, by provision of scheduled passenger trains especially during the summer months, offer a means by which people who, for various reasons, prefer this mode of transportation, could visit and enjoy the picturesque beauty of the basin.

(g) Tourist information centers. There are many varied recreational opportunities available, and the public should be informed of them.

(h) Preservation of significant and important areas of archaeological, historical, and natural science value.

(8) Mitigation measures. Although the White River Basin presently abounds in natural resources, high quality hunting areas are becoming increasingly scarce. The following measures and programs would be included in the plan to compensate for losses in fish and wildlife habitat if it is determined that they are justified.

(a) Tailwater access facilities at the County Line, Myatt Creek, Wild Horse, Wolf Bayou, and Bell Foley Dam and Reservoir projects.

(b) Project lands not needed entirely for primary project purposes should be made available to the State game and fish agencies for wildlife management and public hunting use.

(c) Improvements on these lands would include fencing, land clearing for food plots, development of food plots, and all-weather access roads.

(d) Approximately 1,000 additional acres at the County Line Reservoir site would be licensed to the Missouri Conservation Commission to manage for wildlife production and public hunting.

(e) In connection with the Clover Bend Levee project a water-control structure and pump at the mouth of Shirey Bay and a drainage pipe through the levee at the outlet of Brushy Creek into the Black River.

(f) In connection with the Oil Trough to Hurricane Lake Levee projects, there would be 3 water-control structures at the mouth of Departee Creek, the mouth of Glaise Creek, and in the Glaise Creek drainage ditch.

(g) Development of the large bendway of Bayou Des Arc from about mile 6 to mile 10.5, including water-control structures.

(h) Public access to the sump lakes, bendway cutoffs, and marginal lands along the major stream reaches in connection with the levee projects. Selection of specific access sites would be determined during the detailed design stage of planning through cooperative arrangements with the local levee districts.

(i) Encouragement of private landowners to preserve select tracts of valuable bottom-land hardwood habitat for wildlife management, and to provide hunting opportunities to compensate for wildlife losses incurred as a result of the drainage and floodwater retarding projects.

c. Long-range plan of development.

(1) Long-range planning for outdoor recreation for fish and wildlife is envisioned as a continuing process, consisting of new project proposals and the pursuance of going programs as the need arises and funds become available.

(2) Ten Corps of Engineers main stem and major tributary reservoirs included in the plan would provide an approximate surface area of 30,000 acres for outdoor recreation and fish and wildlife purposes. Some of these are alternatives to other type projects included in the 10- to 15-year plan and would be further considered only in the event that the 10- to 15-year projects are not developed.

(3) Upstream reservoirs included in the plan, include 280 single-purpose floodwater retardation structures, 6 multiple-purpose floodwater retardation and recreation structures, 3 multiple-purpose municipal and industrial water supply impoundments, and 5 single-purpose recreation lakes on National Forest lands. These projects would provide a surface area of about 5,000 acres for outdoor recreation and fish and wildlife purposes.

(4) Elements of the long-range plan needed to protect and enhance outdoor recreation and fish and wildlife resources in the distant future will consist of measures to preserve additional Ozark

streams, providing additional stream access facilities in the basin, preservation of high quality wildlife habitat, and construction of additional impoundment fishing waters. Small-size impoundments, properly constructed, operated, and managed to provide maximum fishing benefits, would be preferred over impoundments primarily designed for other purposes. Public fishing lakes, managed by the State game and fish agencies and distributed at strategic locations in the basin to serve local fishing needs, should be an integral part of the long-range program. Additional scenic drives, hiking trails, and boat access points will be needed to meet future demands.

(5) Established water quality standards suitable to sustain fish and wildlife should be implemented and maintained. The need for low-flow augmentation to increase minimum natural flows for certain Ozark streams during drought periods should be considered in the future development program to enhance float fishing and other recreational uses. A detailed study to determine low-flow requirements for the upper part of the Buffalo National Scenic River is proposed for long-range consideration. The study should include a determination of the feasibility of providing storage for this purpose in a series of small impoundments located on upper tributary streams.

(6) Flood control developments and drainage measures included in the long-range plan would result in further reductions in high quality bottom-land hardwoods and wetland wildlife habitat. Mitigation measures would be required to compensate for these losses and help maintain a quality hunting and fishing environment.

24. HYDROELECTRIC POWER

a. Introduction.

(1) The Federal Power Commission Coordination Study Area K which includes Power Supply Areas 25, 29, 33, 34, and 35 was determined to be a logical market area for electric energy produced in the White River Basin. There are some 30 electric utilities serving the market area with power. It is the responsibility of these utilities to meet the power needs of the area. However, in order to maximize the use of the water resources of the basin, consideration was given to the development of the hydroelectric power potential as a project purpose where applicable. The power requirements and related factors of the market area were analyzed to determine the need for hydroelectric power, its compatibility with other types of electric power, and with the overall water and related land resources plan of development for the basin. The analysis involved an inventory of past and present power production, distribution, and sales; scheduled changes in existing facilities, scheduled additional facilities, and the estimated future electric power requirements of the study area. A general discussion of the needs for power was presented in paragraph 14, and details of the whole power study are presented in Appendix L, Hydroelectric Power.

(2) In studies made by the Federal Power Commission for the comprehensive study investigation, it was determined that all of the conventional hydroelectric power that could be economically developed in the basin could be effectively utilized in Power Supply Area K for peaking power purposes. It was also determined that within certain capacity and time limitations the pumped-storage capacity that could be economically developed could also be utilized in the system.

b. Procedures.

(1) It was determined early in the study that all potential power projects should be given a preliminary evaluation, referred to herein as screening study, to determine their economic justification for possible inclusion in the plan of development. In the case of multiple-purpose projects, the power features would need to be integrated with other purposes, but the screening studies would only reflect the justification of the power increment. As one of the initial steps a list of potential power projects was assembled to which additional projects were added as studies progressed. Before the actual screening was completed a number of the projects were eliminated for various reasons which will be explained later in discussions of the specific projects.

(2) Basic study assumptions and criteria were established for the power studies for both the screening and the more detailed studies that followed. These assumptions and criteria are given in Appendix L.

c. Planning considerations. New power facilities to be developed in the White River Basin were integrated hydraulically with the existing White River hydroelectric system consisting of the Beaver, Table Rock, Bull Shoals, Norfork, and Greers Ferry projects. Consequently, the formulation of all plans was associated with the hydrologic features of the existing system. This was the system upon which power studies were based.

(1) The studies for the addition of conventional hydroelectric power to the existing White River system were confined to the possible inclusion of power as a project purpose in multiple-purpose reservoir development. The inclusion of power in this type project requires that the power feature, in addition to being economically justified, financially feasible, and usable on the area power load, must be compatible with the requirements of all water uses.

(2) Three types of power projects were considered. They were as follows:

(a) Conventional high-head projects on which the power operation was based on a considerable amount of power storage;

(b) Run-of-the-river plants on which the power operation was based on a relatively small storage pool; and

(c) Pumped-storage projects which were of two different types. One type was the reversible or pumped-back unit in connection with the conventional high-head projects, and the other type required construction of a forebay reservoir adjacent to a stream or reservoir which can be used as an afterbay to supply water which can be pumped back into the forebay reservoir.

d. Economic considerations.

(1) It was generally agreed that only those screened projects with a benefit-to-cost ratio of 0.80 or better (based on a 100-year amortization period) would be given consideration for further study. The power revenues would be furnished by the marketing agency (Southwest Power Administration) for only those projects which survive the screening process. For screening studies the separable cost of power was compared with the benefits to determine the benefit-to-cost ratio for adding the power increment. Investment costs were amortized over a 100-year period at 3-1/8 percent interest rate to obtain the average annual equivalent. In more detailed formulation studies this comparison was made and, in addition, the separable cost was compared to the cost of a federally financed large highly efficient steam-electric plant to assure that there was no cheaper way of producing an equivalent amount of power. Also, the total cost allocated to power was compared with revenues to assure repayment within a 50-year period. An amortization period of 100 years and an interest rate of 3-1/4 percent was used in the more detailed economic studies.

(2) For screening purposes, at-market values of $15.50 per kilowatt and 2.2 mills per kilowatt-hour were used for capacity and energy, respectively. These at-market alternative steam-electric capacity and energy costs are composite figures and represent an average of alternative at-market costs in Power Supply Areas 25, 29, 33, 34, and 35 (Kansas, Oklahoma, southern Missouri, Arkansas, Louisiana, western Mississippi, and eastern Texas). Power benefits were determined by applying these values to at-site capacity and energy.

e. Conventional high-head and run-of-the-river projects.

(1) Projects considered.

(a) The project sites considered for conventional and run-of-the-river hydroelectric developments are listed in Table 29 below according to type.

TABLE 29

CONVENTIONAL AND RUN-OF-THE-RIVER PROJECTS
CONSIDERED FOR POWER DEVELOPMENT

Project name	Stream	River mile
High-head conventional:		
Grandview	Kings River	34.6
Galena	James River	50.2
Norfork	North Fork River	4.8
Gilbert	Buffalo River	59.5
Lone Rock	Buffalo River	3.6
Blair Creek	Current River	191.3
Doniphan	Current River	53.7
Water Valley	Eleven Point River	12.6
Myatt Creek	Myatt Creek	2.2
Wild Horse	South Fork Spring River	14.9
Bell Foley	Strawberry River	26.8
Judsonia	Little Red River	40.3
Run-of-the-river:		
Ozark Beach	White River	506.1
Cotter	White River	401.1
Buffalo City	White River	388.1
Wolf Bayou	White River	311.4

(b) Preliminary investigations, consisting principally of a review of available information and inventory of development possibilities, were made on the Gilbert, Lone Rock, Blair Creek, Doniphan, Water Valley, and Judsonia high-head conventional projects and the Cotter and Buffalo City run-of-the-river projects. The Cotter and Buffalo City projects were eliminated from further consideration because they would interfere with the most popular and extensive trout-fishing habitat in Arkansas, the White River below Bull Shoals and Norfork Reservoirs. The Gilbert and Lone Rock projects were eliminated from further consideration because their development would interfere with the development of the Buffalo River as a National River, as desired by the Governor of Arkansas. The Blair Creek and Doniphan projects were eliminated from further consideration because they would interfere with the existing Ozark National Scenic Riverways. The Water Valley project was eliminated from further consideration because of economic factors and because such development would interfere with the use of part of the Eleven Point River as a National Scenic River, which is desired by many interests and which is included in pending Federal legislation. The Judsonia project was eliminated from further consideration because it would interfere with the trout fishery on the Little Red River downstream from the existing Greers Ferry Dam and the further development of the river for the same purpose.

(c) All of these sites discussed above have been studied in detail in previous investigations which were made under various economic conditions. In these previous investigations several of the projects showed economic justification but were never recommended for construction because of conflicting alternatives.

(2) Projects screened.

(a) General. The remaining high-head conventional, run-of-the-river, and reversible unit projects that were not eliminated were screened to see if they merited detailed study. The major controlling factors were that a project must be able to support at least 5,000 kilowatts of installed capacity at a minimum annual plant factor of 5 percent and that the power feature show at least an 0.8 benefit-to-cost ratio. A discussion of the screening studies for each project is presented in the following paragraphs and the economic analysis developed during the screening studies for all projects except the privately owned Ozark Beach project is presented in Table 30 following the discussion.

(b) Grandview Reservoir. The plan considered at the Grandview site includes flood control, hydroelectric power, and recreational purposes. Although the plan considered would provide a substantial power-head, the critical hydro-period inflows to the project are very low. The power storage yields 58 percent of the critical period gross regulated flow, and the 5 percent plant-factor criteria allows for an installation of only 18,000 kilowatts. Although the hydroelectric power benefit-to-cost ratio of 1.24 indicates that the power feature appears to be economically justified on an incremental basis, the flood control feature of the project was not justified economically. The area controlled by the flood control storage is already controlled by the Table Rock and Bull Shoals projects. Because of this, the power feature of the project was not considered for further study.

(c) Galena Reservoir. Two plans for development of the site were screened, namely: a multiple-purpose plan with flood control, recreation, and hydroelectric power using conventional Francis turbines, and a multiple-purpose plan with recreation and hydroelectric power using reversible Francis turbines. These two plans are described below.

1. Plan with conventional hydroelectric power. In the plan considered for flood control, hydroelectric power, and recreation, the hydroelectric power benefit-to-cost ratio in screening was found to be 1.75. However, the flood-control feature of the project is not economically justified. Construction of the project would preclude use of the lower James River as a float stream and recreational area, construction of some watershed protection programs of the Soil Conservation Service, and construction of the upper James River projects by preempting certain benefits. Furthermore, there is known opposition to the project in many areas. For these many reasons, the plan was not studied beyond screening.

2. Plan with reversible turbines. As the ratio of average annual inflow to the critical hydro-period inflow is 2.7 to 1.0, a plan with reversible turbines which would utilize the average annual inflow in the production of firm energy was screened. This was a multiple-purpose plan, having recreation as its other purpose. Although screening of this plan indicated a hydroelectric power benefit-to-cost ratio of 1.91, it met with the same objections as did the plan for flood control, recreation, and hydroelectric power with conventional units. Furthermore, comments of the power marketing agency were unfavorable to the plan, recommending that it not be included in the 10- to 15-year plan and questioning whether it should be retained in the long-range plan. Consequently, this plan was not considered for further study, but was retained in the long-range plan.

(d) Norfork Units 3 and 4.

1. The existing Norfork Dam is located on the North Fork River at river mile 4.8, about 4 miles northeast of Norfork, Baxter County, Arkansas. Generating Unit No. 2 of this existing project began commercial generation in June 1944. Unit No. 1 was placed in service in February 1950. The project was designed initially to include a total of four generating units. However, the actual construction of the project included the installation of only two generating units, the powerhouse shell for two unit bays and one service bay, and penstock openings in the dam with bulkheads in the openings for Units 3 and 4. As completion of the Norfork projects with Units 3 and 4 would be added capacity in the White River Hydroelectric System, this addition has been screened along with the power features of other potential projects.

2. The screening of the Units 3 and 4 addition shows that the benefit-to-cost ratio of these power facilities is 2.2. The high benefit-to-cost ratio indicates that the addition should be considered for further study and inclusion in the 10- to 15-year plan, provided the power can be marketed. Actually, the significant gain in power by this addition is the gain in capacity. There is a small gain in average annual potential energy from Units 3 and 4, resulting from energy generation during periods of high inflow. However, there is an actual small loss in annual firm energy because of the higher average tailwater associated with a larger power discharge from the four-unit operation.

(e) Wolf Bayou Reservoir.

1. Sizing of the power facilities at Wolf Bayou recognizes the desire expressed by those involved in power marketing for the energy equivalent of approximately 1,200 hours per year generation at rated capacity. This energy-capacity relationship indicates a critical-year plant factor of 13.7 percent as compared to the 5-percent plant factor used at other newly screened projects. The higher plant factor for Wolf Bayou is justified on the basis that it will reduce the power discharges and the regulation problems in the

downstream channel. Even with the higher plant factor, a reregulation structure is required to keep the stage fluctuations in the White River within tolerable limits.

2. Screening studies indicate that the assumed plant factor of 13.7 percent allows for an installed capacity of 180,000 kilowatts. The Hydroelectric Power Screening shows a hydroelectric power benefit-to-cost ratio of 1.84. As the overall project appeared to be justified, the Wolf Bayou development for flood control, hydroelectric power, and recreation was considered for the 10- to 15-year plan and further study.

(f) Wild Horse Reservoir. The plan considered at the Wild Horse site included the multiple-purposes of flood control, hydroelectric power, and recreation. Although the plan considered resulted in an average net head slightly above 100 feet, the critical hydro period inflows to the project are less than 100 c.f.s. Consequently, an installed capacity of only 13,000 kilowatts could be supported by the inflow on the 5-percent critical-year plant factor criteria. As the hydroelectric power benefit-to-cost ratio was only 0.71, hydroelectric power was dropped from the project.

(g) Myatt Creek Reservoir. Hydroelectric power was considered at this site in a multiple-purpose project with flood control and recreation. Screening studies indicate that with the 5-percent critical-year plant factor criteria only 3,000 kilowatts of installed capacity could be supported. Consequently, the power features were not considered for economic analysis.

(h) Bell Foley Reservoir. A multiple-purpose project, including flood control, hydroelectric power, and recreation was considered at this site. Although the incremental hydroelectric power benefit-to-cost ratio of 0.94 met the screening criteria of 0.80, power is not incrementally justified. The critical hydro period flows would support an installed capacity of 24,000 kilowatts at a critical-year plant factor of 5 percent. However, studies indicated that only 129,700 acre-feet of flood control storage (8 inches) could be supplied in the plan with power, even with the plan developed to the maximum physical limitations of the site. As 8 inches of flood control storage is less than the desired amount and the storage at the site is more valuable for flood control than for power, the hydroelectric feature was dropped from further consideration.

(i) Ozark Beach. The existing Ozark Beach Dam is located on the White River at mile 506.1, about 3 miles northwest of Forsyth, Missouri. The project is a run-of-the-river private power development owned by the Empire District Electric Company. The present power installation is four 4,000-kilowatt units, or 16,000 kilowatts. The project has been in operation since 1913. However, the present equipment

was installed in 1930. The Company has considered enlarging the plant to increase its generating capacity by an additional 24,000 kilowatts. Their general conclusions are that this would be engineeringly feasible but more information is needed to determine economic feasibility. Therefore, the site is included in the long-range plan for possible development to meet future power demands.

f. Summary of screening study results. A summary of the results of the screening studies for the conventional plants and reversible unit plants is shown on Table 30. At Grandview, Galena, Norfork Units 3 and 4, and Wolf Bayou the power features are economically justified. However, as discussed in the paragraphs above relating to Grandview and Galena, these projects were eliminated from further consideration for the 10- to 15-year plan. They were placed in the long-range plan along with the addition of 24,000 kilowatts at Ozark Beach for possible development to meet future demands. Further detailed studies were conducted on Norfork Units 3 and 4 and Wolf Bayou. The results of these studies will be further discussed following the presentation on adjacent pumped-storage power investigations.

g. Pumped-storage projects.

(1) The investigations relating to the sites of the pumped-storage projects consisted primarily of inspecting topographic maps and making field reconnaissance of several of the more promising sites. From the map study and other sources some 40 possible sites were located. Through further office studies more than 30 of these were eliminated because of insufficient forebay area, excessive long penstocks, and poor afterbay conditions. The six sites listed in Table 31 below were selected for field reconnaissance.

TABLE 31

PUMPED-STORAGE SITES INVESTIGATED

Project name	Adjacent stream and location
Habberton	White River, 7 miles east of Fayetteville, Arkansas
Compton	Buffalo River, 2 miles southeast of Compton, Arkansas
Point Peter	Buffalo River, 3 miles east of Snowball, Arkansas
Optimus	White River, 2 miles southeast of Optimus, Arkansas
Marcella	White River, 3 miles southwest of Marcella, Arkansas
Millers Point	Little Red River, 7 miles west of Heber Springs, Arkansas

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TABLE 30

CONVENTIONAL HYDROELECTRIC POWER ECONOMIC ANALYSIS FOR SCREENING

	Grandview	Galena		Norfolk	Wolf Bayou	Wild Horse	Myatt Creek	Bell Foley
		Conventional	Reversible	Units 3&4				
Annual benefits (at site):								
Capacity ($15.50/kw)	279,000	666,000	2,232,000	1,085,000	2,790,000	202,000	-	372,000
Energy (2.2 mills/kwh)	74,000	132,000	183,000	41,800	924,000	24,000	-	58,000
Total annual benefits	353,000	798,000	2,415,000	1,126,800	3,714,000	226,000		430,000
Annual costs:								
(1) Incremental joint-use power cost	1,187,000	1,969,000	3,950,000	-	6,082,000	1,442,000		2,100,000
(2) Specific cost	4,479,000	7,876,000	26,335,000	-	46,786,000	5,243,000		8,370,000
Separable power cost	5,666,000	9,845,000	30,285,000	12,570,000	52,868,000	6,685,000		10,470,000
Interest during construction	354,000	615,000	1,893,000	589,000	3,304,000	418,000		655,000
Total investment	6,020,000	10,460,000	32,178,000	13,159,000	56,172,000	7,103,000		11,125,000
Annual charges:								
Interest on investment	188,000	327,000	1,006,000	411,000	1,755,000	222,000		348,000
Amortization of investment	9,000	16,000	49,000	35,000	85,000	11,000	-	17,000
Operation and maintenance:								
Ordinary (with supervisory control)	70,000	73,000	85,000	55,000	105,000	70,000	-	70,000
Major replacements	18,000	40,000	60,000	10,000	77,000	16,000	-	25,000
Total annual costs	285,000	456,000	1,266,000 (3)	511,000	2,022,000	319,000	-	460,000
B/C Ratio	1.24	1.75	1.91	2.21	1.84	0.708	-	0.94

(1) Estimated - no cost allocation made
(2) Intake, powerhouse, and switchyard
(3) Includes pumping energy costs: 30,000 m.w.h. @ 2.2 mills/kwh = $66,000

(2) Following the field reconnaissance investigation it was determined that development of both the Compton and Point Peter sites would be in conflict with development of the Buffalo River as a National River and they were dropped from further consideration. Of the remaining four sites, Optimus and Millers Point appeared to be the more promising on the basis of physical characteristics. These two sites are described below. Descriptions of the other four sites are presented in Appendix L.

(a) Optimus site. This site is located on the Bee Hollow tributary of East Livingston Creek, less than a mile from the Wolf Bayou Reservoir site. It is a small cove with an outlet that is constricted to about 50 feet wide at the streambed with relatively steep abutments (30 degrees) on each side. This makes it particularly suitable for an embankment or concrete dam development. A dam 350 feet high and approximately 2,000 feet long at the top would provide a forebay with a maximum reservoir surface elevation of 940 feet m.s.l. The forebay would contain about 19,000 acre-feet of storage capacity with 6,900 acre-feet of the storage in the top 50 feet. This drawdown storage and the 600 feet of average turbine head would support an installation of 500,000 kilowatts on a daily cycle of 7 hours of generation. Construction would require the very minimum of social readjustment because the site is located within the boundaries of the Ozark National Forest. This site is considered worthy of inclusion in the 10- to 15-year plan. However, further study is necessary to bring the design of the project up to survey scope and establish its economic feasibility.

(b) Millers Point site. This site is located on a plateau whose surface is broken intermittently with gradually sloping ravines. Overburden, consisting of silty sand to sandy clay and containing broken residual sandstone fragments, varies in thickness from 4 to 7 feet. A ring dike would form a forebay reservoir with 9,000 acre-feet of storage and 200 surface acres. This facility and an average head of 600 feet would support an installation of 600,000 kilowatts on a daily cycle of 7 hours of generation. Principal favorable factors relating to this project would be the reasonably good potential turbine head, relatively short penstocks (2,400 feet), the use of the existing Greers Ferry Reservoir as an afterbay, and the proximity of the site to existing transmission lines. Any future lakeside development for residential purposes would present social adjustment difficulties. This project is included in the long-range plan for possible development to meet future demands.

h. Selected plan for power.

(1) General. The 10- to 15-year plan for hydroelectric power development includes the addition of units 3 and 4 to the conventional high-head hydroelectric power plant at the existing Norfork project, the run-of-the-river hydroelectric power plant at the Wolf Bayou site, and a pumped-storage hydroelectric power development at the Optimus site. The long-range plan includes conventional high-head hydroelectric

power installations at the Grandview and Galena sites, a run-of-the-river hydroelectric power installation at the existing privately owned Ozark Beach project, and a pumped-storage hydroelectric development at the Millers point site. Pertinent engineering features of these projects are shown in Table 32. Information on the projects and economic justification of the power increment of 10- to 15-year projects are presented below.

(2) Norfork Units 3 & 4. At the existing Norfork multiple-purpose project two 42,500-kilowatt hydroelectric power generating units would be added to the existing plant which contains two 35,000-kilowatt units. The proposed units were sized on the basis of the largest physical-sized turbine which could be installed in the existing unit space. The estimated investment cost of Units 3 and 4 is $13,500,000. The annual cost of the units is $570,900, the annual power benefits are $1,411,000, and the benefit-to-cost ratio is 2.47. The alternative cost of power is $731,000 which results in a comparability ratio of 1.28. The marketing agency estimates that power revenues that will result from addition of these two units will be adequate to pay the annual operation and maintenance costs, the marketing expenses, and the investment cost allocated to power. The annual amount required to retire the investment cost was estimated on the basis of a 50-year period and a 3-1/4 percent interest rate. In view of the above findings this power installation is both economically and financially sound.

(3) Wolf Bayou. The hydroelectric facilities in the Wolf Bayou multiple-purpose project would be a run-of-the-river installation consisting of four 45,000-kilowatt units or a total installation of 180,000 kilowatts. The units were sized on the basis of providing about 1,200 hours of generation per year which is generally desired by marketing interests. In addition, the installation is about as large as can be utilized at the site and maintain fluctuations below the dam within reasonable limits, even with a downstream reregulation structure. The annual separable cost for power is $1,959,000, the total annual amount allocated to power is $2,193,000, and the average annual benefits are $3,852,000 which shows that the power installation is economically feasible. The estimated alternative annual cost for a federally financed thermal-electric plant is $2,322,000 which gives a comparability ratio of 1.19. The marketing agency estimates that the power revenues would be adequate to meet operation and maintenance costs, marketing expenses, and repay the investment cost of $57,526,000 allocated to power within 50 years based on a 3-1/4 percent interest rate. In view of the above findings this power installation is economically and financially sound.

(4) Optimus. The proposed plan provides for a pumped-storage installation of 500,000 kilowatts. However, as stated previously, only preliminary reconnaissance and office studies were made for this plan, and further study will be necessary to determine the engineering and economic feasibility for the project. An unexplored cave has been discovered in the

TABLE 32

ENGINEERING FEATURES OF HYDROELECTRIC PROJECTS
SELECTED FOR THE 10- TO 15-YEAR AND LONG-RANGE PLANS(1)

Feature	10- to 15-Year Plan			Long-Range Plan			
	Norfork (Units 3&4)	Optimus (Bee Hollow)	Wolf Bayou	Grandview	Galena (with reversible unit)	Ozark Beach (Additional Units)	Millers Point
Location of dam site:							
Stream	North Fork River	-	White River	Kings River	James River	White River	Little Red River
Miles from mouth	4.8	-	311.4	34.6	50.2	506.1	-
Afterbay for pumped storage	-	Wolf Bayou	-	-	-	-	Greers Ferry
Drainage area, sq. miles	1,806	-	10,796	532	959	4,362	-
Purpose	FC,P	P-S-P	FC,P,R	FC,P,R	P,R	P	P-S-P
Dam:							
Type	Concrete gravity	Earthfill	Concrete gravity & earthfill	Concrete gravity & earthfill	Concrete gravity & earthfill	Concrete buttress & earthfill	Ring dike, earthfill
Height, feet	216	325	137	159	164.0	75	60
Length, feet	2,624	2,010	3,764	2,000	3,000	1,270	12,500
Elevations, feet, m.s.l.:							
Top of dam	590	945	375	1,118.0	1,115.0	722	1,080
Top of flood control pool	580	-	340	1,105.0	-	-	-
Top of power pool	552	940	320	1,090.0	1,105.0	(5)701	1,075
Rated pool	530.2	-	-	1,066.0	1,089.5	-	-
Minimum pool (2)	528.3	890	310	1,062.0	1,089.5	694	1,030
Tailwater assumed for power studies	379.1	340-314	Variable	965.9	964.2	653	435-487
Streambed	374	620	238	959.0	951.0	647	-
Areas, acres:							
Top of flood control pool	30,700	-	17,300	6,685	-	-	-
Top of power pool	21,990	156	11,760	5,140	18,900	(5)2,200	200
Rated pool	16,495	-	-	-	-	-	-
Minimum pool (2)	16,070	119	9,470	2,955	14,500	1,400	Undetermined
Storage capacity, ac.-ft:							
Total	1,983,000	19,000	618,700	301,100	846,040	(5)28,000	Undetermined
Flood control	731,800	-	288,700	86,500	-	-	-
Power	448,300	6,900	106,300	111,800	258,390	13,500	9,000
Inactive and dead	802,900	12,100	223,700	102,800	587,650	14,500	Undetermined
Net head, feet:							
Maximum (3)	176	(6)626	(7)80	121.8	144.3	(8)48	(6)640
Average, critical hydro period	162	600	60	111.1	132.8	-	(6)605
Design	160	600	60	105.0	133.0	48	-
Rated	-	-	46	-	-	-	-
Minimum (4)	2 @ 144 2 @ 143	(6)550	46	93.0	119.4	-	(6)569
Generating equipment:							
Number & type of generating units	2-Francis	Undetermined	4-Kaplan	1-Francis	3-Francis (2-reversible)	-	Reversible Francis
Capacity of each generating unit, kw	42,500	Undetermined	45,000	18,000	48,000	-	Undetermined
Power available:							
Capacity, kw							
Installed	85,000	500,000	180,000	18,000	144,000	24,000	600,000
Dependable (30 Sep peak)	85,000	500,000	180,000	18,000	144,000	(9)	600,000
Minimum peaking	82,400	Undetermined	180,000	-	-	0	-
Energy, million kwh:							
Annual firm	-7	Undetermined	225	7.9	63.1	(9)	-
Average annual	22	Undetermined	420	33.5	83.1	Undetermined	-
Plant factor, percent:							
Firm energy	6.0	-	14.3	5.0	5.0	(9)	-
Average annual	16.1	-	26.6	-	-	-	-

(1) Critical hydro period from 4 June 1953 to 30 September 1954 based on operation of existing Federally owned White River Basin projects as a hydraulically integrated system.
(2) Minimum pools established by routing through the period of maximum drawdown from 4 June 1953 to 23 December 1954 while maintaining rated capacity through 30 September and generating firm energy each month.
(3) Maximum net head computed assuming pool at top of power pool and one unit (smaller) operating at rated capacity.
(4) Minimum net head computed assuming minimum pool elevation and all units operating at full gate.
(5) Pool at top of 4-foot flashboards.
(6) Gross head while generating.
(7) Maximum net head at Wolf Bayou determined from proposed operating criteria for flood control.
(8) Maximum gross static head.
(9) Dependable capacity and firm energy are limited by high tailwater during, and following, flood periods.

Legend:
- FC - Flood control
- P - Conventional power
- R - Recreation
- P-S-P - Pumped-storage power

forebay area which might be of national significance for recreation and difficult to seal for storage. This could preclude development of the site for power and points out the necessity for further studies, not only on this site but on all pumped-storage sites investigated.

(5) Long-range projects. Projects included in the long-range plan for possible development to meet future needs are as follows:

(a) Grandview multiple-purpose flood control, power, recreation, and fish and wildlife project with a conventional power installation of one 18,000-kilowatt unit at a minimum annual plant factor of 5 percent.

(b) Galena multiple-purpose power, recreation, and fish and wildlife project with a power installation of one 48,000-kilowatt conventional unit and two 48,000-kilowatt reversible units at a minimum annual plant factor of 5 percent. The total capacity of the plant is 144,000 kilowatts.

(c) Privately owned Ozark Beach project with an additional run-of-the-river power installation of 24,000 kilowatts.

(d) Millers Point pumped-storage project with an installation of 600,000 kilowatts.

25. NAVIGATION

a. General.

(1) The White River is about 720 miles in length, of which the lower half is considered as physically practical for future navigation development. The slope of the river varies from about 1.7 feet per mile in its middle reaches at mile 360 near Calico Rock, Arkansas, to about 0.4 foot per mile in the lower reaches near its mouth. The major change in slope is near Batesville, river mile 300.2, where the river enters the Coastal Plain. The White River is very crooked throughout its entire length. In the Coastal Plain portion where the river meanders considerably there are many bends with a radius of less than 1,000 feet. These bends coupled with the existing project channel dimensions are definite restrictions to the size and the length of the tows which may be expected to successfully navigate the stream.

(2) There are four existing navigation projects within the basin including improvements to parts of the White, Black, and Current Rivers. Because of lack of traffic, all of the projects were declared inactive many years ago. However, traffic on the White River began to increase about 1959, and in 1961 snagging and dredging operations were resumed below Augusta, river mile 201, on the White River. In this reach of the river the authorizing act did not specify channel depth and

width for navigation, but a depth of 4-1/2 feet and a width of 100 feet have been accepted as satisfying its requirements.

(3) The annual movement of commerce on the lower White River during the six-year period 1960-1965 averaged 498,659 tons. The most significant factor during this period was the increase from 315,172 tons shipped in 1960 to 879,251 tons in 1965. It is also significant to point out that there were increases each year except for 1963 when shipments declined. This decline was undoubtedly due to the low flows experienced in the White River during the fall months of 1963. During the extreme low flow period of September and October of that year, the controlling depth in the channel was reduced to only 3 feet at times. This depth eliminates almost entirely any interchange with the Mississippi River traffic and imposed rigid limitations on the type of barges and towing vessels which could move on the White River.

(4) At the public hearings held in April 1965 local interests presented statements in favor of improving the White River for navigation. They requested the establishment of a permanent 9-foot channel from the mouth to Newport, Arkansas, and requested that navigation studies consider possible improvements to, or above, Batesville. Also, at a meeting held at Searcy, Arkansas, on 28 December 1967, local interests requested that navigation be considered on the Little Red River which enters the White River at river mile 182.6.

(5) In connection with this comprehensive study, a limited waterway traffic survey was made by mail and by personal interviews with potential shippers and receivers for purposes of estimating future shipment on the river. Although the survey was rather limited there were indications of considerable interest in an improved waterway on the lower White River.

b. Plans considered.

(1) During preliminary studies consideration was given to providing a reliable navigation channel that would have a 9-foot depth and 150-foot bottom width to Batesville. Plans considered included both locks and dams and open-river navigation. For the following reasons open-river navigation was eliminated at this time in favor of the lock and dam plan.

(a) The lack of available storage for augmentation of low flows.

(b) It was estimated that developing additional storage coupled with higher construction and maintenance dredging costs would be more expensive and less reliable than the lock and dam plan.

(c) Demands on low flows of the White River are projected to increase for irrigation and water supply withdrawals.

(d) Cutoffs could not be constructed due to the lowering effect the steeper stream gradient would have on low-flow water levels, thus leaving the numerous sharp bends.

(e) The lock and dam plan would decrease the total length of the waterway by about 50 miles.

c. Disposition of the navigation project. Because of limited funds the navigation studies were curtailed as soon as the results of the preliminary studies indicated that future possibilities were favorable for a navigation project on the lower White River upstream to Newport, Arkansas. The studies further indicated that the navigation project should provide a channel with a minimum depth and bottom width of 9 feet and 150 feet, respectively, to Newport, Arkansas, and that this project should be initiated within the next 10 to 15 years. In view of this finding, the White River Basin Coordinating Committee decided that any comprehensive plan for the basin should recognize the potential for future navigation on the lower White River, probably by locks and dams, and that all planning for the basin should be compatible with such a project. Since the Committee made this decision the Public Works Committee of the United States Senate has approved a resolution authorizing a navigation study on the White River upstream to Batesville, Arkansas. It was determined that this authority would also allow for study of navigation on the Little Red River. The estimated cost of the study is $250,000.

26. MUNICIPAL AND INDUSTRIAL WATER SUPPLY

a. General.

(1) Water supply requirements for the basin are presented in Section III of this Appendix and Appendix N. These requirements were developed and projected on the basis of population and industrial growth and, in the case of municipal water supply, the estimated increases in per capita usage of water. An inventory of existing supplies was made and deducted from the requirements to obtain net needs. From an overall basinwide viewpoint, existing supplies are far in excess of those needed to meet requirements for some time in the future. However, there are areas which have insufficient water supplies to meet their present or projected future needs. These areas are mostly located in the upstream reaches of Ozark Plateaus streams where flows are not adequate, especially during dry periods, to meet the needs. Ground water of sufficient quality or quantity is either not available or is difficult and expensive to develop.

(2) Several cities or towns are located in headwater areas or even on drainage divides where they must depend on ground water or storage to meet demands. Springfield, Missouri, and Fayetteville, Springdale, Bentonville, Rogers, Jonesboro, and Stuttgart, Arkansas, are some of the larger cities in or immediately adjacent to the basin which are located

on drainage divides and would experience water shortages in the future without proper planning. The Fayetteville, Springdale, Bentonville, and Rogers complex has already made provisions for future water supply from the existing Beaver Reservoir. The Beaver Water District which represents the above cities has contracted for storage to supply 35.0 m.g.d. from the Beaver Reservoir for municipal and industrial water supply for these cities and smaller surrounding communities, and the Water District has furnished assurance that within 25 years from the date that the project is first placed in operation they will contract for additional storage to supply 85.0 m.g.d.

(3) In the two-county area of Greene and Christian Counties, Missouri, water supply projects indicate a net municipal and industrial water supply requirement of 24.7 m.g.d. by 1980, 38.3 m.g.d. by 2000, and 55.5 m.g.d. by 2020. Nearly all of this requirement will be needed in the Springfield area. During the initial hearings held in April 1965 and by correspondence representatives of the Springfield City Utilities requested the Corps of Engineers to consider water supply for the city by reservoir storage.

(4) During the course of the study several smaller towns and communities requested the Soil Conservation Service to consider water supply storage in their upstream watershed projects to meet immediate and future needs. These towns and communities include St. Paul, Winslow, West Fork, Huntsville, Berryville, Green Forest, Alpena, Yellville, Western Grove, Marshall, Floral, Pleasant Plains, Leslie, and Pangburn, all in Arkansas.

b. Selected 10- to 15-year plan.

(1) Harrison, Arkansas. A plan which includes a reservoir on the East Fork of Crooked Creek to furnish a dependable municipal and industrial water supply of 3.5 m.g.d. for Harrison, Arkansas, was recommended for construction in a prior report. This report was discussed in paragraph 7a of this Appendix. This comprehensive report recognizes this project as a unit of the comprehensive plan to meet the basin needs.

(2) Springfield, Missouri, area.

(a) Several alternative plans were considered for meeting the municipal and industrial water supply needs of the city of Springfield, Missouri, and the surrounding area. These include separate studies by a private engineering firm who considered combinations of storage and ground water, and each separately. This firm concluded that, because the sustained yield of the water-bearing formation has not been determined, ground water should be presently considered as a source on an interim basis only. The firm also concluded that the most attractive plan for water supply would be a reservoir at the Webster-Greene County Line referred to as the County Line site. This information is included

in a report prepared by Burns and McDonnell Engineering Company, Kansas City, Missouri, entitled "Water Resource Studies, City Utilities of Springfield, Missouri," dated 1967.

(b) As discussed under the flood control plan in paragraph 22d, the County Line Dam and Reservoir project was found to be the most economic project of the three alternatives studied in the upper reach of the James River to meet the area needs for flood control, water supply, water quality control, recreation, and fish and wildlife.

(c) The County Line project would have 190,000 acre-feet of storage for water supply and water-quality control. This storage would provide a dependable yield of 64.8 m.g.d. which is the full dependable yield of the 153 square-mile drainage area above the site based on the driest period of record. The yield allocated to water supply is 37.4 m.g.d. The total estimated separable cost of adding water supply to the project is $18,000. The estimated average annual water supply benefits based on the cost of an alternative at the site for a water-supply-only project is $426,000. Total cost allocated to water supply is $181,000. Therefore, the water supply portion of the project is well justified.

(3) Cities of Stuttgart and Jonesboro. These two cities are located in headwater areas of Coastal Plain streams where sites for storage are practically non-existent. Other possible sources of water supply for the two cities are ground water or conduits from distant streams which have relatively high sustained yields. It was determined that the cities would not experience difficulties in meeting future water supply needs from ground-water sources provided they made provisions in the near future to obtain well sites spaced approximately 1/2 mile apart.

(4) Other towns and communities. The 2020 needs for the urban towns and communities mentioned in paragraph 26a could be met by storages provided in the upstream watershed reservoirs. Alternatives investigated to meet these needs included ground water, other reservoir sites, and streamflow diversion. A multiple-purpose major tributary reservoir at mile 1.4 on Archey Fork, Little Red River, and discussed in paragraph 22d was considered for water supply for Clinton, Arkansas. The cost of this project greatly exceeded the benefits, and it was determined that water supply for Clinton could be developed more economically in an upstream watershed reservoir. The selected projects shown in Table 33 were found to be the most economical means of meeting the water supply needs of the communities. Economic justification information for these projects is included in Section VI.

TABLE 33

UPSTREAM WATERSHED RESERVOIRS
INCLUDING WATER SUPPLY STORAGE

Community (Arkansas)	Watershed No.	Site No.	Project purposes	Water supply storage (acre-feet)	Water supply yield (m.g.d.)
St. Paul	1	8	FWR & WS	499	0.4
Winslow and West Fork	3	11 & 13	do	710	0.2
Huntsville	6	5	do	2,000	0.4
Berryville	9 & 11	1 & 5	WS-FWR&WS	1,519	4.3
Green Forest and Alpena	19	4	FWR & WS	970	0.6
Yellville	(1)29	3	do	1,054	0.2
Western Grove	(1)29	18	do	517	0.1
Marshall	33	6	do	2,000	0.8
Floral	44	2	do	507	0.1
Pleasant Plains	92	15	do	1,001	0.1
Leslie	94	21	do	974	0.1
Clinton	(1)97	4	do	2,000	0.8
Pangburn	101	11	do	502	0.2

(1) Projects included in the long-range plan due to lack of local-interest ability to provide requirements of local cooperation at this time and low to marginal economic justification of overall watershed plan.

Legend:
FWR - Floodwater retardation
WS - Water supply

c. Long-range plan. It should be noted that the estimated water supply need in the Springfield, Missouri, area is 55.5 by the year 2020, but that the yield of the County Line project allocated to water supply is only 37.4 m.g.d. This is essentially the same as the estimated need of 38.3 m.g.d. for the area in the year 2000. After that date, a re-evaluation of the water quality control needs may indicate that some of the water quality control water could be used for water supply or other sources will have to be developed to meet the estimated water supply needs of the Springfield area. Three storage sites are included in the long-range plan for future development which could provide additional water supply for the area. These are the Kinser Bridge and Galena sites on the James River and a site on Finley Creek.

27. WATER QUALITY CONTROL

a. General.

(1) Present pollution problems in the basin result from inadequate or overloaded municipal waste treatment facilities and from

various industrial operations. Pollution has resulted from dairy feedlot operations, where cattle wastes have been allowed to enter streams and ground-water formations; from industrial operations, where raw wastes, excavated materials, and gravel washings have been dumped into streams; and from agricultural operations, where pesticides and herbicides have been sprayed directly on streams or washed into streams after application. Oxygen depletion, rapid, wide temperature changes, and toxic materials have caused periodic and occasional heavy fish kills in some streams. The temperature changes result from curtailment of power generation on weekends during the summer.

(2) Problem areas where water quality control storage is the most practicable solution to the problems, are the James River between the city of Springfield, Missouri, and the Table Rock Reservoir and the West Fork of the White River between the city of Fayetteville, Arkansas, and the Beaver Reservoir. It is estimated that by the year 2020 average annual supplemental flows of 27.4 and 12.5 m.g.d. will be required to adequately assimilate the wastes emanating from the cities of Springfield and Fayetteville, respectively.

b. Alternative methods of water quality control considered.

(1) Advanced or tertiary waste treatment systems to remove a higher degree of the carbonaceous BOD were investigated. To prevent pollution in the James River below Springfield and West Fork of the White River below Fayetteville, the following levels of treatment must be provided: 94 percent in 1980; 95 percent in 2000; and 96 percent in 2020 for Springfield and 97 percent in 1980, 2000, and 2020 for Fayetteville. It is more economical to provide water quality control storage in reservoir projects than to construct facilities necessary to provide such high degrees of treatment. If a higher degree of protection was provided in lieu of water quality control storage, the incidental recreation and fish and wildlife benefits that would accrue to higher flows in the streams would be eliminated.

(2) The use of ground water for supplemental flow releases to the problem streams was considered but was rejected since the quantities required are not available from this resource.

(3) Subsurface disposal of the wastes from Fayetteville and Springfield was considered but was not feasible because of the porosity of the underground strata and the danger of polluting the ground-water supply.

(4) Piping of wastes to larger streams was considered but was not feasible because of the mountainous terrain.

(5) Reservoir regulation at the County Line project at mile 107.8 on the James River and an upstream watershed project at mile 14 on the West Fork of the White River were found to be the most economic means of providing water quality control on the James River below

Springfield and the West Fork of the White River below Fayetteville, respectively. This determination was made on the basis of water quality levels expected to prevail after secondary treatment of effluents. Accordingly, storage for streamflow augmentation is not provided in lieu of waste treatment.

c. Description of selected projects.

(1) The County Line Reservoir would include 190,000 acre-feet of storage for municipal and industrial water supply and water quality control which would provide a dependable yield of 64.8 m.g.d. The yield allocated to water quality control amounts to 27.4 m.g.d. which is equivalent to the estimated 2020 needs. A multiple-level outlet structure would be provided to assure water high in dissolved oxygen content. The annual cost allocated for water quality control is $122,000, and the separable cost of adding water quality control storage in the project is $15,000. The average annual benefits are $282,000 and are based on the cost of providing water quality control by advanced or tertiary treatment. The annual cost of the cheapest alternative has been estimated as the same amount. Thus, the water quality control portion of the project is well justified economically.

(2) The upstream watershed multiple-purpose reservoir at mile 14, site 12 in Watershed No. 3, on the West Fork of the White River would include 6,885 acre-feet of conservation storage for water quality control purposes. The reservoir would also include floodwater detention storage. The water quality control storage would provide a dependable yield of 12.5 m.g.d., the projected 2020 quality control need in the White River between Fayetteville and the headwaters of the Beaver Reservoir. A gate-controlled outlet would be provided in the structure for controlled releases. The estimated annual cost allocated to water quality control is $33,500. The estimated average annual benefits and the annual cost of the cheapest alternative are $44,300.

d. Other pollution control measures.

(1) Throughout the basin, principally in the Ozark Plateaus, there are many small cities and rural communities located in the headwaters of tributary streams which have potential localized pollution problems. The cities and towns are West Plains, Willow Springs, Mountain Grove, Seymour, and Ava, Missouri; and Harrison, Jonesboro, Walnut Ridge, and Green Forest, Arkansas. Effluents from these communities are discharged, after treatment, into streams which have little or no base flow, except where there are springs. In these areas, provision of reservoir storage for quality control is not a feasible means of pollution abatement. For all communities located in the headwaters of streams, high efficiency of waste treatment plant operation will be required. At least secondary waste treatment with final sedimentation and, in most instances, chlorination of effluents will be necessary for bacteriological control.

(2) In the Coastal Plain, where stream slopes are flat and runoff is sluggish, adequately treated chlorinated municipal and industrial return flows from the city of Jonesboro and smaller communities could be diverted for irrigation. Return flows from the large scale fish-farming operations planned for this area, which will be rich in plant nutrients, could be retained in holding ponds for diversion to irrigated areas. Full utilization of these return flows is needed for stream pollution control and to reduce the heavy irrigation water demands on ground-water aquifers.

(3) In agricultural areas of the basin, principally in the Black River, Cache River and lower White River Basins, continued surveillance and enforcement action by the States will be needed to prevent stream pollution from insecticide spraying. In Greene County, Missouri, and in other areas of the Ozark Plateaus where developments of the dairy industry are most prevalent, improved feedlot waste facilities are needed as an initial step for abatement of ground water and stream pollution. Because of the porous and cavernous topography, dairy feedlots could be paved and wastes diverted to concrete retention and treatment lagoons.

e. Projected quality. With adequate control measures as previously outlined, the municipal, industrial, and agricultural return flows will adversely affect only limited reaches of the smaller tributary receiving streams. The projected waste discharges are not expected to be of a type or magnitude to adversely affect the White River or its major tributaries. These streams have low mean monthly flows as high as 450 to 3,500 cubic feet per second, based on a once-in-20-years drought recurrence interval. These flows are sufficient to assimilate all projected adequately treated waste discharges from these sources without any measurable quality degradation. No anticipated use of the streams should be impeded.

28. IRRIGATION

a. General.

(1) In connection with the formulation of the irrigation part of the plan, an analysis was made of past and present irrigation development and future irrigation potentials. Consideration was also given on how to utilize more efficiently the natural resources of the White River Basin area, including all types of irrigation and sources of water supply from either ground or surface waters. Consideration was given to soils, topography, growing season, rainfall, project development problems, and needs for developments.

(2) The irrigation needs in the basin as presented in Section III of this Appendix, and in Appendix O, were estimated on the basis of lands which can profitably use additional water for crop production and are physically suited for irrigation. Water requirements

were determined by an analysis of rainfall records, the probability of rainfall occurrence, consumptive use of crops, expected rainfall effectiveness, and field application losses and efficiencies. Table 24 on page P-34 shows that during a drought year it is projected that the Coastal Plain portion of the basin will have a gross irrigation requirement of 1,240,000; 1,291,000; and 1,303,000 acre-feet, respectively, in 1980, 2000, and 2020. Based on continued use of ground water and construction of additional on-farm reservoirs it is estimated that 517,000; 545,000; and 561,000 acre-feet of the above gross requirement will have to come from streamflow during the three projection periods.

(3) Table 34 shows the amount of these diversions expected to be obtained by streamflow diversion at various locations in the basin to satisfy the irrigation needs. These water requirements were based on the projected acreage of the various crops to be irrigated within each of the sub-basins. The projected requirement for each county within a sub-basin was estimated by considering the amount of water used for irrigation in 1965 in the county. Projected requirements were increased for those counties having moderate use but which had a high potential for irrigation development.

TABLE 34

PROJECTED GROSS DIVERSION REQUIREMENTS FOR IRRIGATION (1)

Location	Gross annual diversion requirement (acre-feet)			30-Day period peak diversion rate (Gross)(c.f.s.)		
	1980	2000	2020	1980	2000	2020
Corning	12,000	14,000	15,000	37	46	51
Black Rock	18,000	22,000	23,000	59	73	81
Newport	38,000	45,000	48,000	122	151	167
DeValls Bluff (2)	420,000	427,000	434,000	4,520	4,557	4,582
Clarendon	29,000	37,000	41,000	92	123	139
Total	517,000	545,000	561,000	4,830	4,950	5,020

(1) Streamflow diversion only. Does not include water supplied by storage reservoirs.

(2) Includes water requirements for authorized Grand Prairie Irrigation Project.

b. Authorized irrigation project.

(1) The only authorized irrigation project in the basin is in the Grand Prairie Region near Stuttgart, Arkansas. There were about 190,000 acres in the project area at the time the project was authorized. Of this amount 125,000 acres were in the White River Basin and 65,000 acres were in the Bayou Meto Watershed of the Arkansas River Basin.

(2) House Document No. 255, 81st Congress, 1st session, that was the basis for the authorization of the project, recommended that water

be supplied to this highly developed agricultural region because of a rapid decline in ground-water levels due to prolonged pumping for irrigation purposes. The area is greatly dependent upon agriculture and there are many agriculture-related enterprises which would suffer economically if the area should lose its source of water supply for irrigation.

(3) Water would be supplied to the project area by the diversion of 2,750 c.f.s., including transportation losses, from the White River at DeValls Bluff, Arkansas. The water would be distributed throughout the area by a system of canals.

c. Selected 10- to 15-year plan.

(1) Grand Prairie Irrigation Project.

(a) The rapid decline in ground-water levels as well as a deterioration in the quality of the ground water in the area of the authorized Grand Prairie Irrigation Project indicates that a project will be necessary for this area within the next 10 to 15 years. It has been estimated that by 1980 about 210,000 acres would have to be irrigated from diversions from the White River. Of this amount about half would be for rice and half for other crops. This will require a diversion rate of 4,350 c.f.s., including diversion losses, and an annual water requirement by diversion of 275,000 acre-feet. The increase in water requirements above those of the authorized project is the result of an anticipated increase in the acreage maintained in the production of rice and other irrigated crops.

(b) The water requirements shown in Table 34 include the water requirements for the Grand Prairie area.

(2) Upstream watershed projects.

(a) In addition to the authorized development in the Grand Prairie, there is an immediate need for irrigation water in several small upland areas. Irrigation storage is provided as a project purpose in 5 of the upstream floodwater retarding structures included as a part of the 10- to 15-year plan. The storage provided by these structures would be released as needed and distributed to the irrigable land with individual irrigation systems. These systems would be used to irrigate truck, corn, silage, and alfalfa. Because of topography or other physical conditions overhead sprinkler systems would generally be used. Table 35 lists the multiple-purpose structures which would include irrigation storage. Cost and benefit data for the structures are presented in Section VI.

TABLE 35

MULTIPLE-PURPOSE STRUCTURES WITH IRRIGATION STORAGE

Reach No.	Watershed No.	Watershed Name	Structure No.	Drainage area (sq. mi.)	Irrigation storage (ac.-ft.)	Irrigable area (acres)	Area irrigated (acres) (1)	Irrigation pool (acres)
1	4	Richland Creek	10	35.10	2,000	1,672	1,000	195
20	92	Departee Creek	8	3.30	528	331	264	54
20	92	do	12	15.70	2,093	1,311	1,046	290
21	94	Middle Fork-Little Red River	13	7.50	1,000	640	500	63
21	94	do	18	3.84	512	329	256	32
		Total		65.44	6,133	4,283	3,066	634

(1) Acres on which project benefits were calculated.

(3) Private development. In addition to the 5 multiple-purpose structures which will include irrigation storage, there is an immediate need for irrigation development throughout the Coastal Plain area of the basin. However, this development is expected to be accomplished on an individual basis and no projects are identified for inclusion in the 10- to 15-year plan.

d. Long-range irrigation development.

(1) The rate of future irrigation development is dependent upon the individual farmer and his desire for supplemental irrigation. It is probable that the individual will not seek to develop potentially irrigable land until he is convinced that he will be benefited economically. The farmer must consider such items as costs, demand for the various crops, market availability, and acreage controls, in addition to water and associated factors. When additional development occurs, it will utilize the source of water which can furnish the required amount of water most economically. Depending upon the location in the basin, this source could be a well, reservoir, or stream diversion. Until this individual development has progressed as much as is economically possible, there will be little demand for larger projects. Local interests will probably be reluctant to accept the financial responsibility connected with large project developments until there is a decline in ground-water availability or quality that would require widespread or project-type water supply systems.

(2) One project identified as having a potential for future development is located on the White River at Crockett's Bluff, Arkansas. This project would divert about 215 c.f.s. from the White River and distribute the water through 13 miles of irrigation canals to irrigate

10,700 acres of rice, cotton, and soybeans. The total installation cost of this project is presently estimated at $440,000. This project was not included in the 10- to 15-year plan because of the lack of interest shown by the local people concerned with the project.

SECTION VI - DEPARTMENT OF AGRICULTURE PROGRAMS

29. OBJECTIVES AND PLANNING CONSIDERATIONS

a. The basic objectives of U. S. Department of Agriculture participation in the Basin Comprehensive Study are to assist in integrating agricultural and forest resources, their treatment and multiple uses, into a comprehensive plan for the best use or combination of uses of water and related land resources to meet both short-term and foreseeable long-term needs. Programs formulated by USDA will assist in promoting economic growth and development.

b. Basinwide investigations on a subwatershed basis resulted in identification of short-term and long-range forestry and agricultural land and water problems and rural water management needs and solutions with regard to land treatment, erosion control, sediment reduction, flood prevention, drought and irrigation, agricultural drainage, water supply, fish and wildlife development, water quality control, outdoor recreation development, and other purposes. Studies were coordinated with all interested local, State, and Federal agencies. Basin program formulation was performed jointly by all cooperating agencies. The needs and desires of local interests were incorporated. Appraisal of the effects of small watershed potential projects on downstream areas and projects was made.

30. SCREENING STUDIES

a. Subdivision of watershed.

(1) The White River Basin was subdivided into 134 subwatersheds and areas "A" and "B" for purposes of evaluation of potential upstream structural and watershed protection measures. These subwatershed delineations are shown on the Basin Reach Map, Plate P-20. Studies were made by subwatersheds of the needs and justification for watershed protection, flood prevention, agricultural and nonagricultural water management, recreation, fish and wildlife, and other purposes. Water storage in small potential upstream impoundment-type structures was investigated for flood prevention, municipal and industrial, recreation, irrigation, fish and wildlife, water quality control, and various multiple-purpose combinations.

(2) Field examinations of 124 of the 136 subwatershed areas were made. The 12 existing subwatersheds in various stages of planning or construction under the current small watershed program were excluded from this study. Consideration was given to the above listed applicable

measures and more detailed studies completed in those subwatersheds selected where project installation is needed and feasible in the next 10 to 15 years.

b. Upstream impoundment-type structures. An inventory of all potentially feasible floodwater retarding structure sites was completed for each upstream subwatershed where floodwater, sediment, erosion, scour, and other related damages occur to tributary flood plain lands. Structure inventory considerations included physical and economic suitability for water storage for flood prevention, sediment, municipal and industrial, irrigation, recreation, fish and wildlife, quality control, and various combinations of multiple-purpose storage. Other considerations for structure locations were: meeting existing and future water storage needs, both within and outside the individual subwatersheds; obtaining desired levels of flood protection; the expressed needs and desires of local interests; and alternate downstream reservoirs in some areas which may provide a better combination of total basin benefits.

c. Channel improvement.

(1) Field examinations were made of all watersheds in the Coastal Plain area of the basin to determine the need and construction feasibility of multiple-purpose channel projects for flood control and agricultural water management. Those watersheds which were apparently subject to frequent main stem overflow were considered as being not feasible for project construction in the foreseeable future. Other watersheds did not appear to have problems of sufficient magnitude to justify a channel improvement project. Included in the above classifications were Subwatersheds Nos. 54, 93, 107, and area "A."

(2) Subwatersheds being investigated under provisions of Public Law 566 included Nos. 28, 46, 65, 67, 69, 80, 86, 87, 116, 117, 126, and 131. These projects were not investigated further as they were either in the planning stage or under construction. Subwatershed No. 134, Laconia Circle Watershed, was considered as being a Corps of Engineers study area because its drainage outlet is through the White River Levee.

(3) All other subwatersheds having drainage problems were studied more intensively and plans for channel construction were developed. These subwatersheds were justified by a favorable benefit-to-cost ratio. Major channel locations planned for each economically feasible subwatershed are shown on Potential Works of Improvement Maps included in this Appendix. Also included are design details and economic data in summary tables for each watershed.

(4) Multiple-purpose channels were designed for flood prevention and agricultural water management. The installation of these channels will help alleviate the problem of damage resulting from flooding by providing enough channel capacity to confine flood waters within the channel. This will help to reduce the damaging effects of overland flow and sediment deposition by floodwaters. Such channels will also serve as an outlet for the orderly removal of excess surface water from cropland which will be beneficial both to the growing crop and to the overall farming operation. These channels were designed to provide relief from storms of a recurrence frequency of about once in 2 to 5 years.

(5) Channel location determinations were based on a need for protection in an area, physical feasibility of construction, and an apparent economic feasibility based on project costs and benefits. Channels were not planned with the primary purpose of bringing new land into production and benefits were based on present land use and cropping patterns.

(6) An additional factor in project development was the intensity of interest shown by the local people. Those economically feasible subwatersheds where local interest was great were included in the plan for immediate construction. Where little local interest was evident, economically feasible projects were recommended for inclusion in the long-range program.

d. <u>Irrigation</u>.

(1) Field studies were made of areas having a potential for irrigation development. Records of rainfall, streamflow, and ground-water availability were made to determine the need and feasibility of developing an irrigation water supply system. Soils data were analyzed to determine irrigation water requirements for the various crops normally grown in the area.

(2) Irrigation studies were made to determine the need for supplemental water as a means of increasing crop yield or preventing crop damage from deficient moisture. Studies were made of the adequacy of the moisture supplied by rainfall for crop production as well as the availability of surface and subsurface water for irrigation purposes. Consideration was given to providing storage for irrigation water in upland areas in multiple-purpose impoundment-type structures. The lack of a dependable and adequate subsurface source in these areas dictated the need for reservoir storage. In the alluvial areas irrigation water must be supplied from wells, irrigation

reservoirs, or by stream diversion. The decline of ground-water availability in some areas has meant an increase in reservoir construction. With suitable construction sites being limited in number, water for irrigation must be supplied by stream diversion in these areas if irrigation development is to increase in the future.

(3) Selected projects were justified on the basis of benefits resulting from an increase in yield. No increase in allotted crop acreage was used in calculating benefits from irrigation.

(4) Additional information concerning irrigation studies in the basin may be found in Appendix O, Irrigation.

e. Land treatment and remaining watersheds. These studies indicated that no small watershed-type structural measures could be justified at the present time in the following 25 subwatersheds: Nos. 2, 5, 7, 13, 17, 21, 24, 25, 30, 31, 34, 42, 43, 54, 60, 61, 76, 93, 95, 96, 98, 99, 107, 134, and area "A." Watershed protection (land treatment) measures for installation in the 10- to 15-year program are planned except in area "A." Limited potential benefited areas, frequent main stem flooding, inadequate drainage outlets, lack of economic justification, lack of local interest, and other factors resulted in elimination of subwatershed-type structural projects in these 25 subwatersheds. A future need, not anticipated in this study, may develop for surface storage of water. Should the need develop, many physical sites are available for storage in impoundment-type structures in 20 of these subwatersheds.

31. U. S. DEPARTMENT OF AGRICULTURE WATER AND RELATED LAND RESOURCE PROJECTS AND MEASURES INCLUDED IN THE 10- TO 15-YEAR PLAN

a. Watershed protection (land treatment) measures.

(1) General. The results of the coordinated studies undertaken in the White River Basin indicate a need for establishing, by 1980, those land treatment and management measures and practices that will enhance the full development of the water and related land resources. The application of watershed protection practices on rural land will reduce erosion and the resultant sediment pollution to rivers, streams, and reservoirs and result in improved hydrologic soil conditions and productivity of forest lands, grasslands, and croplands. The recreation and wildlife practices will increase the private sectors' participation in this field of conservation effort. In addition, the application of the planned practices will create a more wholesome environment, natural beauty, and other elements essential to wholesome living.

(2) Watershed protection needs. The land treatment needs study indicated 3,388,000 acres of cropland, 4,051,700 acres of grassland and range land, and 928,800 acres of forest land needing treatment.

In addition, there are an estimated 18,090 acres of land needing treatment measures for recreation and 510,980 acres to be preserved or developed for wildlife. It was found that approximately 10,800 acres are critical sediment producing areas and need intensive treatment. An estimated 226 miles of roadbanks also produce excessive amounts of sediment.

(3) Installation of watershed protection measures. The Coordinating Committee of the White River Basin included the installation of the watershed protection measures in the 10- to 15-year project so maximum project benefits could be achieved. The estimated cost of this treatment is $103,677,400. Table 36 gives the needs and total cost for each watershed. To install these measures within the projected time, it is estimated that $54,879,100 will be required for acceleration. The non-Federal share of this cost is $34,020,200 while the Federal share is $20,858,900. It is estimated that landowners and operators will seek loans of about $1,352,000 for conservation loans to install their share of the practices. The remaining $48,798,300 should be available under current Department of Agriculture programs. The Federal cost of this is estimated to be $15,332,000 and the non-Federal about $33,466,300.

(4) Critical area treatment. Some 6,200 acres of critical sediment-producing areas will be treated with appropriate vegetative practices. Since there will be some on-site benefits from the treatment of these areas, the landowners and operators will cost-share in their installation. Table 37 gives the cost of these accelerated measures. However, there are 4,600 acres of severely gullied land in Subwatersheds Nos. 109, 110, and 111. The treatment will include minor earth structures and adapted vegetation practices. The cost of treating these 4,600 acres is included under structural measures and is not included in the cost of land treatment. The total cost of $211,300 will be a Federal cost, with easements furnished by the local sponsoring organization. The costs are shown as additions to Tables 46 and 47 which are presented later in this section.

(5) Previous land treatment cost. Landowners and operators of the basin have undertaken extensive application of similar land treatment measures. It is estimated that such measures have already been installed to an extent of $71,319,000 within the basin. This does not include the land treatment measures installed in association with the planned Public Law 566 watersheds within the basin.

TABLE 36
PROPOSED LAND TREATMENT MEASURES
DEPARTMENT OF AGRICULTURE

Water-shed No.	Reach and Watershed Name	Watershed Area (Acre)	Proposed Land Treatment Measures: Cropland (Acre)	Grassland (Acre) 1/	Forest Land(Ac)	Recreation(Ac)	Wildlife (Acre)	Estimated Cost Total (Dollar) 2/
	REACH NO. 1							
	White River-Source to Beaver Reservoir							
1	Upper White River	174,720	16,100	87,800	23,500	130	2,400	1,308,900
2	White River-Brush Creek Reach	61,440	6,600	32,300	5,100	60	900	510,300
3	West Fork of White River	78,080	10,400	42,600	11,600	90	1,300	937,100
4	Richland Creek	94,080	7,400	50,400	9,500	50	1,200	617,700
5	Beaver Reservoir Laterals	140,800	9,400	55,700	12,000	40	3,400	636,700
6	War Eagle Creek	209,920	18,300	125,200	12,600	100	3,000	1,086,800
	REACH TOTAL	759,040	68,200	394,000	74,300	470	12,200	5,097,500
	REACH NO. 2							
	White River-Beaver Res.to Below Mouth Kings R.							
7	White R-Beaver Res.to Below Mouth Kings River	160,000	14,300	43,600	7,300	70	1,900	543,300
8	Upper Kings River	106,880	6,800	58,000	7,900	50	1,400	375,700
9	Lower Kings River	135,040	10,100	43,600	12,100	70	2,100	479,900
10	Dry Fork-Kings River	33,280	3,100	19,100	8,500	20	500	206,000
11	Osage Creek	104,960	16,000	60,900	9,700	60	1,600	442,400
	REACH TOTAL	540,160	50,300	225,200	45,500	270	7,500	2,047,300
	REACH NO. 3							
	James River-Source to Below Mouth of Flat Creek							
12	Upper James River 3/	172,800	-	-	5,500	-	-	63,500
13	Middle James River 3/	129,920	500	1,500	3,900	-	-	142,500
14	Finley Creek 3/	171,520	500	1,100	11,300	-	-	309,400
15	Lower James River 3/	193,920	24,500	52,600	9,300	10	130	1,504,100
16	Flat Creek 3/	200,960	33,900	80,300	12,700	80	1,800	1,717,600
	REACH TOTAL	869,120	4/ 96,400 155,800	4/ 86,100 221,600	42,700	4/ 100 190	4/ 2,000 3,930	4/ 2,921,100 6,658,200
	REACH NO. 4							
	White River-Below Mouth KingsR.to Table Rock Dam							
17	Table Rock Laterals(excl. James River)3/	176,640	11,400	21,900	3,000	10	250	580,800
18	Indian Creek	40,320	2,100	21,000	1,900	20	400	211,300
19	Long Creek	99,200	19,100	63,300	3,800	20	1,600	713,000
20	Yokum-Dry Creeks	88,320	10,300	62,300	6,000	50	1,400	363,100
	REACH TOTAL	404,480	4/ 700 43,600	4/ 800 169,300	14,700	4/ 10 110	4/ 200 3,850	4/ 24,200 1,892,400
	REACH NO. 5							
	White R-Table Rock Dam to Mo-Ark Line(R.M.477.4)							
21	Taneycomo Laterals 3/	208,000	1,100	3,900	14,800	-	40	524,300
22	Bull-Swan Creeks 3/	241,920	1,200	2,600	11,200	-	-	437,800
23	Beaver Creek 3/	247,680	-	-	21,500	-	-	464,600
	REACH TOTAL	697,600	4/ 53,300 55,600	4/ 86,700 93,200	47,500	4/ 120 120	4/ 1,460 1,500	4/ 2,426,000 3,852,700
	REACH NO. 6							
	White River-Mo-Ark Line(R.M.477.4)toBullShoalsDam							
24	Upper Bull Shoals Laterals 3/	119,040	-	-	4,800	-	120	189,800
25	Lower Bull Shoals Laterals 3/	236,800	18,500	123,300	22,500	30	2,700	1,664,300
26	Little North Fork Laterals 3/	236,800	600	12,400	15,600	80	700	519,900
	REACH TOTAL	592,640	4/ 19,800 38,900	4/ 23,600 159,300	42,900	4/ 90 200	4/ 1,500 5,020	4/ 722,100 3,096,100
	REACH NO. 7							
	White R-Bull Shoals Dam to Below Mouth Crooked Cr							
27	White R-Bull Shoals Dam to Below Crooked Creek	71,040	8,900	62,800	7,300	200	2,500	572,900
29	Lower Crooked Creek	241,920	33,100	156,700	29,600	70	3,700	2,058,100
	REACH TOTAL	312,960	42,000	219,500	36,900	270	6,200	2,631,000
	REACH NO. 8							
	White River-Below Mouth of Crooked Creek to Below Mouth of Sylamore Creek							
30	Big Buffalo River	140,160	3,400	41,300	3,600	80	1,400	296,100
31	Little Buffalo River	90,240	2,500	37,500	3,600	50	900	229,400
32	Big-Richland Creeks	243,200	5,100	73,400	7,250	100	1,800	459,200
33	Middle Buffalo River	208,000	1,700	9,700	7,200	10	400	264,700
34	Lower Buffalo & White River Laterals	248,320	2,700	37,000	20,250	280	3,200	1,014,300
41	White River-North Fork River to Sylamore Creek	226,560	15,600	70,000	24,600	230	10,500	1,260,500
43	Sylamore Creek	142,080	11,700	56,200	15,800	120	1,900	1,397,800
	REACH TOTAL	1,298,560	42,700	325,100	82,300	870	20,100	4,922,000
	REACH NO. 9							
	North Fork River-Source to Norfork Dam							
35	Upper North Fork River 3/	136,320	400	1,200	7,000	-	4,500	497,300
36	Lower North Fork River 3/	227,840	-	-	6,000	-	-	197,800
37	Upper Norfork Dam Tributaries 3/	211,200	4,900	46,900	16,000	280	1,900	804,700
38	Upper Bryant Creek 3/	218,240	-	-	12,000	-	-	204,700
39	Lower Bryant Creek 3/	154,240	-	-	6,000	-	-	99,900
40	Lower Norfork Dam Tributaries 3/	208,000	16,900	119,100	15,000	290	4,900	1,337,900
	REACH TOTAL	1,155,840	4/ 66,900 89,100	4/ 116,000 283,200	62,000	4/1,530 2,100	4/ 3,000 14,300	4/ 3,192,400 6,334,700
	REACH NO. 10							
	White River-Below Mouth of Sylamore Creek to Below Mouth of Wolf Bayou							
42	White R-Sylamore Creek to Below Wolf Bayou	222,720	15,400	80,500	22,800	60	6,700	1,656,200

TABLE 36 (con.)

Water-shed No.	Reach and Watershed Name	Watershed Area (Acre)	Proposed Land Treatment Measures Cropland (Acre)	Grassland (Acre) 1/	Forest Land (Ac.)	Recreation (Ac)	Wildlife (Acre)	Estimated Cost Total 2/ (Dollar)
	REACH NO. 11							
	White River-Below Mouth of Wolf Bayou to Above Mouth of Black River							
44	Salado Creek + Mainstem Laterals	111,360	16,000	45,700	13,700	50	1,700	921,200
45	Polk Bayou + Mainstem Laterals	140,800	29,300	76,800	5,500	60	4,200	1,432,600
	REACH TOTAL	252,160	45,300	122,500	19,200	110	5,900	2,353,800
	REACH NO. 12							
	Black River-Source to Clearwater Dam							
47	Upper Black & Clearwater Laterals 3/	249,600	10,500	11,800	2,600	90	6,400	322,800
48	West Fork of Black River	102,400	6,800	7,800	2,700	20	4,400	200,300
49	Sinking Creek	54,400	3,800	4,300	3,500	10	2,300	136,200
50	Logan Creek	168,320	10,900	12,800	3,200	30	7,200	320,800
	REACH TOTAL	574,720	4/ 3,100 35,100	4/ 6,700 43,400	12,000	4/ 25 175	4/ 700 21,000	4/ 175,200 1,155,300
	REACH NO. 13							
	Black River-Clearwater Dam to Poplar Bluff							
51	Black River-Clearwater Dam to Poplar Bluff	222,060	25,800	13,100	8,100	4,500	4,800	1,451,200
	REACH NO. 14							
	Black R-Poplar Bluff to Below Mouth of Cane Cr.							
52	North Inter-River Drainage District	99,200	60,700	8,200	200	2,200	1,300	3,466,200
53	Cane Creek + Black River Mainstem	219,520	66,000	19,700	12,100	4,200	3,700	4,062,400
	REACH TOTAL	318,720	126,700	27,900	12,300	6,400	5,000	7,528,600
	REACH NO. 15							
	Black River-Below Mouth of Cane Creek to Above Mouth of Spring River							
54	Black River-Pocahontas Reach	74,240	26,900	8,400	-	10	3,100	164,200
55	Corning Ditches	62,080	53,500	2,000	-	30	4,300	530,300
61	Current River-Jacks Fork to Van Buren, Mo.	166,400	3,400	12,700	5,100	-	14,700	479,300
62	Pike Creek	92,800	6,700	5,500	5,100	-	6,500	264,300
63	Current River-Van Buren, Mo. to Buffalo Creek	207,360	7,800	16,900	15,300	-	6,700	671,000
64	Lower Current River	120,320	23,400	18,900	950	-	3,000	629,200
66	Black Creek	26,880	19,500	900	-	105	1,700	290,500
68	Little Running Water Ditch	12,800	11,400	200	-	-	200	121,300
	REACH TOTAL	762,880	152,600	65,500	26,450	145	40,200	3,150,100
	REACH NO. 16							
	Current River-Source to Below Mouth Jacks Fork							
56	Upper Current River	241,280	4,800	61,100	18,800	-	56,500	2,122,100
57	Current River-Akers to Jacks Fork	196,480	2,900	24,700	9,700	-	33,100	837,900
58	Spring Valley Creek	92,800	3,100	17,100	8,200	-	13,320	656,300
59	Upper Jacks Fork 3/	120,960	900	29,000	15,500	-	17,900	1,055,400
60	Lower Jacks Fork	159,360	2,000	15,100	10,200	-	20,100	625,800
	REACH TOTAL	810,880	4/ 2,600 16,300	4/ 4,900 151,900	62,400	-	4/ 200 141,120	4/ 132,500 5,430,000
	REACH NO. 17							
	Eleven Point River-Source to Mouth							
74	Upper Eleven Point River 3/	199,680	40	240	18,500	-	320	295,900
75	Middle Fork Eleven Point River 3/	53,120	-	-	9,000	-	-	190,700
76	Eleven Point River-Greer Spring Reach 3/	226,560	300	9,900	14,600	-	13,100	653,400
77	Eleven Point River-Alton Reach 3/	155,520	200	400	24,800	-	100	614,900
78	Eleven Point Laterals 3/	102,400	700	32,000	10,100	10	1,100	468,300
79	Lower Eleven Point River	28,160	4,200	8,400	2,600	-	300	181,600
	REACH TOTAL	765,440	4/ 34,760 40,300	4/ 65,160 116,100	79,600	4/ 200 210	4/ 2,000 16,920	4/ 1,760,200 4,165,000
	REACH NO. 18							
	Black River-Above Mouth of Spring River to Above Mouth of Strawberry River							
70	Upper Spring River 3/	165,760	-	-	25,000	-	-	250,000
71	Myatt Creek & Middle Spring River	179,840	7,000	29,400	23,000	10	3,300	771,400
72	South Fork Spring River	210,560	14,800	99,100	18,000	20	4,200	1,124,400
73	Lower Spring River 3/	221,440	38,700	71,700	24,000	10	11,300	1,505,500
81	Big Cypress Creek	27,520	4,800	13,400	1,100	-	800	198,400
	REACH TOTAL	805,120	4/ 21,600 86,900	4/ 40,500 254,100	91,100	4/ 160 200	4/ 1,500 21,100	4/ 1,094,300 4,944,000
	REACH NO. 19							
	Black R-Above Mouth of Strawberry to White River							
82	Lower Black River Mainstem	26,880	15,100	6,100	-	-	2,200	249,000
83	Upper Strawberry River	151,680	33,900	114,400	13,900	30	7,400	1,567,700
84	Piney Fork-Strawberry River	75,520	23,800	47,800	4,600	20	5,100	877,200
85	North Big Creek-Strawberry River	122,880	22,800	41,000	7,000	10	9,300	637,600
	REACH TOTAL	376,960	95,600	209,300	25,500	60	24,000	3,331,500

TABLE 36 (con.)

Water-shed No.	Reach and Watershed Name	Watershed Area (Acre)	Proposed Land Treatment Measures Cropland (Acre)	Grassland (Acre)1/	Forest Land(Ac)	Recrea. (Acre)	Wildlife (Acre)	Estimated Cost Total 2/ (Dollar)
	REACH NO. 20							
	White River-Above Mouth of Black to Above Mouth of Little Red River							
88	Upper Village Creek	106,880	62,700	16,000	-	-	3,900	787,700
89	Lick Pond Ditch	27,520	21,100	10,800	-	-	900	290,400
90	Village Creek-Swan Pond Reach	67,840	49,300	2,500	-	-	5,200	552,500
91	Lower Village (Mayberry)	83,200	74,600	5,500	-	-	5,800	574,600
92	Departee Creek + White River Laterals	224,000	90,100	76,000	11,400	30	7,300	1,864,000
102	Overflow Creek-Little Red River	39,040	20,900	13,800	1,600	-	620	255,700
	REACH TOTAL	548,480	318,700	124,600	13,000	30	23,720	4,324,900
	REACH NO. 21							
	Little Red River							
94	Middle Fork-Little Red River	188,800	16,100	103,000	10,600	70	1,600	1,026,700
95	Greers Ferry Laterals-Little Red River	220,160	8,800	70,300	6,000	150	1,700	640,100
96	Upper South Fork-Little Red River	92,800	6,900	73,400	1,300	-	300	448,500
97	Archey Fork + Laterals-Little Red River	104,320	7,600	75,700	500	10	400	645,300
98	Turkey-Beech-Raccoon Creeks	128,000	3,000	24,800	3,500	50	1,400	371,600
99	Red River-Greers Ferry to Pangburn	51,200	7,900	14,400	6,300	70	700	343,500
100	Big Creek + Mainstem Little Red River	204,800	31,800	59,200	18,000	80	3,000	1,155,200
101	Indian Creek-Little Red River	96,000	11,700	42,400	3,100	60	1,500	346,000
	REACH TOTAL	1,086,080	93,800	463,200	49,300	490	10,600	4,976,900
	REACH NO. 22							
	Cache River and Bayou DeView							
109	Upper Cache River (Ditch #1)	175,360	99,500	13,600	10,100	680	11,200	1,952,800
110	Lower Cache - Ditch #1	160,640	82,800	21,900	7,900	60	5,400	1,066,900
111	Cache River-Egypt to Light	102,400	91,800	13,600	2,900	30	3,800	1,077.300
112	Cache River-Amagon to Egypt	106,240	75,600	7,200	-	10	6,000	871,600
113	Cache River-Patterson to Amagon	117,120	57,100	12,000	-	-	7,900	691.500
114	Overcup Ditch	22,400	13,000	2,600	-	-	1,500	148,900
115	Cache River-Clarendon to Patterson	127,360	69,800	6,300	-	10	4,900	708,500
118	Bayou DeView-Flag Slough Reach	121,600	102,900	3,500	-	30	4,200	1,283,800
119	Lower Bayou DeView	210,560	139,300	6,100	-	10	-	1,347,800
120	Cow Lake	28,160	16,800	2,300	-	-	2,000	234,100
121	Possum Creek	10,880	4,700	200	-	-	700	28,000
	REACH TOTAL	1,182,720	753,300	89,300	20,900	830	47,600	9,411,200
	REACH NO. 23							
	Bayou Des Arc							
93	White River-Augusta to DeValls Bluff	49,280	18,500	2,700	-	-	1,700	262,400
103	Cypress Bayou	154,240	79,800	60,600	17,100	50	7,500	938,400
104	Bull Creek	100,480	38,400	17,600	7,300	-	1,500	583,400
105	Upper Des Arc Bayou	124,160	15,500	30,000	5,200	-	1,700	394,500
106	Lower Des Arc Bayou	116,480	62,900	10,000	1,700	10	2,400	803,400
	REACH TOTAL	544,640	215,100	120,900	31,300	60	14,800	2,982,100
	REACH NO. 24							
	Wattensaw Bayou							
107	Wattensaw Bayou and White River Laterals	188,800	83,100	31,000	5,600	40	8,100	1,340,200
	REACH NO. 25							
	Big and Dials Creeks							
122	Dials Creek	30,080	20,700	800	-	-	200	296,700
123	Big Slash	21,120	13,700	500	-	-	100	195,800
124	Big Creek-Flat Fork Reach	106,240	79,000	2,400	-	20	4,800	840,900
125	Big Creek-Piney Fork Reach	179,200	114,800	6,400	-	30	6,400	1,084,400
127	Lower Big Creek	181,760	119,900	7,400	450	70	7,000	1,394,500
128	Big Cypress-Big Creek	85,120	57,900	1,900	-	10	600	860,600
129	Prairie Cypress-Big Creek	21,760	5,900	500	-	-	20	91,400
	REACH TOTAL	625,280	411,900	19,900	450	130	19,120	4,764,300
	REACH NO. 26							
	Lower White River							
108	White River-DeValls Bluff to St. Charles	162,560	26,200	6,400	-	10	2,900	504,200
130	Lower White River Tributaries	192,000	82,200	5,000	-	20	12,200	1,111,000
132	Big Bayou Lagrue	163,840	94,800	13,000	-	10	5,400	1,463,400
133	Little Bayou Lagrue	86,400	72,400	3,200	-	-	4,500	901,400
134	Laconia Circle Watershed	11,520	10,300	500	-	10	700	200,200
	REACH TOTAL	616,320	285,900	28,100	-	50	25,700	4,180,200
	BASIN TOTAL	16,534,400	3,388,000	4,051,700	928,800	18,090	510,980	103,677,400

1/Includes woodland grazed.
2/Includes State matching funds for technical assistance to Forest and ACP cost sharing.
3/Data on cropland and grassland could not be broken down to a watershed basis (see footnote 4).
4/Extrapolation of land treatment by reaches in areas where detailed basic data was not available.

TABLE 37

ACCELERATED LAND TREATMENT

Reach Number	Federal Cost (Dollar) 1/						Non-Federal Cost (Dollar)				Total Cost (Dollars)
	Technical Assistance	Soil Survey	Practice Application			Total	Practice Application			Total	
			Critical Areas	Roadside Stabiliza.	Other		Critical Areas	Roadside Stabiliza.	Other		
1	343,000	33,000	3,800	16,800	552,000	948,600	1,000	7,200	1,656,100	1,664,300	2,612,900
2	116,000	24,000	3,200	14,000	212,000	369,200	800	6,000	636,900	643,700	1,012,900
3	521,000	116,000	3,200	14,000	729,300	1,383,500	800	6,000	2,188,000	2,194,800	3,578,300
4	138,000	33,000	2,600	11,200	200,400	385,200	600	4,800	601,400	606,800	992,000
5	329,000	95,000	1,900	8,400	409,000	843,300	500	3,600	1,227,100	1,231,200	2,074,500
6	233,000	116,000	1,900	8,400	324,800	684,100	500	3,600	974,600	978,700	1,662,800
7	198,000	14,000	1,300	5,600	286,400	505,300	300	2,400	859,100	861,800	1,367,100
8	326,000	57,000	5,100	19,600	519,700	927,400	1,300	8,400	1,559,200	1,568,900	2,496,300
9	453,000	123,000	3,800	16,800	692,000	1,288,600	1,000	7,200	2,076,200	2,084,400	3,373,000
10	128,000	10,000	600	2,800	178,200	319,600	200	1,200	534,800	536,200	855,800
11	128,000	11,000	1,300	5,600	266,400	412,300	300	2,400	799,100	801,800	1,214,100
12	72,000	75,000	2,600	11,200	109,000	269,800	600	4,800	327,000	332,400	602,200
13	132,000	28,000	600	2,800	153,800	317,200	200	1,200	461,500	462,900	780,100
14	701,000	40,000	1,300	5,600	835,500	1,583,400	300	2,400	2,506,400	2,509,100	4,092,500
15	225,000	81,000	2,600	11,200	330,000	649,800	600	4,800	989,800	995,200	1,645,000
16	359,000	104,000	3,200	14,000	590,000	1,070,200	800	6,000	1,770,000	1,776,800	2,847,000
17	294,000	124,000	3,800	16,800	487,700	926,300	1,000	7,200	1,463,200	1,471,400	2,397,700
18	357,000	50,000	3,200	14,000	535,600	959,800	800	6,000	1,606,800	1,613,600	2,573,400
19	200,000	17,000	12,800	28,000	369,000	626,800	3,200	12,000	1,106,900	1,122,100	1,748,900
20	323,000	24,000	3,800	16,800	478,000	845,600	1,000	7,200	1,434,200	1,442,400	2,288,000
21	377,000	48,000	3,800	16,800	529,400	975,000	1,000	7,200	1,588,400	1,596,600	2,571,600
22	781,000	52,000	128,000	44,800	1,026,600	2,032,400	32,000	19,200	3,079,700	3,130,900	5,163,300
23	210,000	24,000	1,900	8,400	321,800	566,100	300	3,600	965,500	969,600	1,535,700
24	100,000	8,000	600	2,800	147,300	258,700	200	1,200	441,900	443,300	702,000
25	376,000	30,000	-	-	525,800	931,800	-	-	1,577,600	1,577,600	2,509,400
26	284,000	27,000	-	-	467,900	778,900	-	-	1,403,700	1,403,700	2,182,600
Total	7,704,000	1,364,000	196,900	316,400	11,277,600	20,858,900	49,500	135,600	33,835,100	34,020,200	54,879,100

1/Approximately $1,352,000 will be necessary for conservation loans to apply accelerated land treatment program.

b. Structural measures.

(1) Individual structural measures outside of subwatershed-type projects (see Table 45) are included in the 10- to 15-year plan for the following 7 subwatersheds: Nos. 9, 22, 35, 36, 47, 48, and 57. These structural measures consist of 9 single-purpose recreation structures and 1 single-purpose municipal and industrial structure. One additional potential single-purpose recreation structure is provided in a subwatershed-type project in Subwatershed No. 77. Complete watershed protection measures are planned for installation in these subwatersheds during the next 10- to 15-year period.

(2) Subwatershed-type projects listed in the 10- to 15-year plan include 849 floodwater retarding or multiple-purpose structures in 50 subwatersheds. Plans in 10 of the above subwatersheds include combinations of floodwater retarding structures and 974 miles of channel improvement. Other structural measures include 2,543 miles of multiple-purpose channel improvement for flood prevention and agricultural water management in 29 subwatersheds. Irrigation storage was provided in 5 potential multiple-purpose upstream structures located in Subwatersheds Nos. 4, 92, and 94. Cost and benefit data are listed in appropriate tables. Watershed protection measures are planned for installation in the above 79 subwatersheds and in Subwatershed No. 107 within the next 10- to 15-years. Table 38 lists pertinent data for all planned structural measures.

c. Subwatershed projects upstream structural measures.

(1) Flood prevention.

(a) Structural measures.

1. Severe flood problems exist in most of the subwatersheds in upstream areas of the White River Basin. In 50 of the subwatersheds these problems are of sufficient magnitude to justify project-type action to reduce flood damages. The installation of upstream floodwater retarding structures and other flood prevention and watershed protection measures would be a local undertaking with Federal technical and financial assistance. The improvements would be installed when local interests are prepared to assume their responsibilities. It is recommended that the total program be installed in 10 to 15 years.

2. Floodwater retarding structures or other impoundment-type structures are needed and feasible in 50 subwatersheds. Plans in 10 of these include both floodwater retarding structures and channel improvement. This segment of the plan provides for 849 impoundment-type structures having floodwater detention storage as a purpose. Other storage purposes served by 36 of the above structures incorporating multiple-purpose features are municipal and industrial, recreation, irrigation, fish and wildlife, and water quality control. All structure locations are shown on Potential Works of Improvement Maps, Plates P-21 to P-46.

TABLE 38

PERTINENT DATA ON STRUCTURES
SOIL CONSERVATION SERVICE - UPSTREAM WATERSHED PROJECTS

Purpose	Sub-Watersheds (No.)	Structures (No.)	Total Storage (Ac.Ft.)	Channel Improvement (Miles)
IMPOUNDMENT-TYPE STRUCTURES				
Single Purpose:				
Flood Prevention	50	813	1,102,073	-
Recreation	7	10	21,840	-
Municipal & Industrial	1	1	1,767	-
Multiple Purpose:				
Flood Prevention & Recreation	15	17	123,069	-
Flood Prev. & Municipal & Industrial	10	11	48,336	-
Flood Prevention & Irrigation	3	5	28,697	-
Flood Prev. & Fish & Wildlife	2	2	19,318	-
Flood Prev. & Water Quality Control	1	1	12,192	
Subtotal - Impoundment-type structures		1/860	1,357,292	-
Multiple Purpose:				
Flood Prevention & Agricultural Water Mgt. Channel Improvement (not associated with FWR structures)	29	-	-	2,543
Multiple Purpose:				
Flood Prevention & Agricultural Water Mgt. Channel Improvement (associated with FWR structures)	10	-	-	974 3/
Totals - 10-15 Year Plan	2/	860	1,357,292	3,517

1/Floodwater storage as a project purpose is planned in 849 structures. No flood storage planned as a project purpose in 10 single purpose recreation sites and 1 single purpose site for municipal and industrial storage.

2/Direct addition not valid due to overlapping purposes in may subwatersheds. Subwatershed-type projects are planned in 79 subwatersheds.

3/Includes 6 miles of flood prevention channel improvement.

3. Pertinent reservoir data summarized by subwatersheds, including quantities of storage by purposes, are shown in structure data Table 39. Structure installation costs and annual costs and benefits are summarized by watersheds, as shown in Table 40. Individual structure storage data, design features, and costs, are listed in appropriate tables in each subwatershed preliminary investigation report prepared during the basin study. Current upstream structure design criteria were used. Hydrologic design criteria not listed on Table 39 are shown in Appendix C.

(b) Cost. Using the 1965 price base, the total estimated installation cost of the above listed 849 structures allocated to flood prevention, including miles of flood prevention channel improvement, is $134,790,700 of which $127,764,400 would be borne by Federal funds and $7,026,300 by non-Federal funds. The total estimated annual cost of these measures, including $186,500 annual operation and maintenance costs, would be $4,493,400. Costs and benefits by purposes are summarized in Table 43 which is presented later in this section.

(c) Benefits. Flood prevention benefits are based on reduction of floodwater and sediment damages in the flood plain, and the more intensive use of the flood plain that would result from the reduction of the flood hazards. The damage reduction benefits were determined as the difference between the estimated average annual damages with and without the planned improvements. On the basis of prices prevailing in 1965, average annual costs allocated to flood prevention were estimated to be $4,493,400 and average annual benefits were estimated to be $10,311,000. The benefit-to-cost ratio was 2.3:1.

(d) Cost sharing. The upstream structural measures for flood prevention on non-Federal lands would be elements of complete watershed development projects and would be installed as local undertakings with Federal financial and technical assistance. Local interests would be required to provide all lands, easements, rights-of-way, and relocations necessary for the installation of the flood prevention measures. Local interests also would be required to maintain and operate the improvements after completion. Contracts for upstream reservoirs on Federal lands with storage for flood prevention would be administered by the Department of Agriculture.

(2) Municipal and industrial storage (water supply.)

(a) Structural measures. Investigations by the U. S. Geological Survey determined that ground water is not available at reasonable depths or in appreciable quantities at all locations in the Ozark Plateau portion of the White River Basin. The development of surface water resources was considered to be the most practical and economical method of meeting the demand for water for municipal and industrial use in the upstream areas. This segment of the plan provides for municipal and industrial storage in 11 potential multiple-purpose floodwater retarding and municipal and industrial sites located in Subwatersheds Nos. 1, 3, 6, 11, 19, 33, 44, 92, 94, and 101. Under existing

TABLE 39
STRUCTURE DATA - UPSTREAM IMPOUNDMENT-TYPE STRUCTURES
SOIL CONSERVATION SERVICE UPSTREAM WATERSHED PROJECTS

Watershed Nos.	Structural Measures and Purpose 1/	Drainage Area Controlled	Surface Area: Sediment Pool 50-Yr.	Surface Area: Flood Prevention Pool	Surface Area: Recreation Pool	Surface Area: Municip.& Indust. Pool	Surface Area: Fish & Wildlife Pool	Surface Area: Irrigation Pool	Surface Area: Water Qual. Control Pool	Storage: Sediment Pool 50-Yr.	Storage: Total Sediment 100-Yr.	Storage: Flood Prevention Pool	Storage: Recreation Pool	Storage: Municipal & Indust. Pool	Storage: Fish & Wildlife Pool	Storage: Irrigation Pool	Storage: Water Qual. Control Pool	Storage: Total	Remaining Storage	Volume of Fill
Subwatershed Projects		(Sq.Mi.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(Cu.Yd.)
1	30 FWR, 1 FWR&M-I	155	577	2,277	-	100	-	-	-	3,549	7,543	47,034	-	499	-	-	-	55,076	114,850	5,039,000
3	11 FWR, 1 FWR&WQ, 2 FWR&M-I	57	149	1,026	-	65	-	-	245	818	2,721	17,999	-	710	-	-	6,885	28,315	37,150	3,089,000
4	13 FWR, 1 FWR&I	87	199	1,528	-	-	-	195	-	1,284	4,225	25,833	-	-	-	2,000	-	32,058	27,225	1,791,000
6	21 FWR, 1 FWR&M-I	151	534	2,508	-	325	-	-	-	4,002	8,714	45,027	-	2,000	-	-	-	55,741	74,100	4,544,000
8	13 FWR, 1 FWR&F.W.	74	209	1,282	-	-	340	-	-	1,732	3,934	21,267	-	-	3,996	-	-	29,197	72,300	2,387,000
10	5 FWR	12	52	231	-	-	-	-	-	275	623	3,315	-	-	-	-	-	3,938	17,300	471,000
11	5 FWR, 1 FWR&M-I	58	128	731	-	36	-	-	-	1,292	3,119	16,643	-	500	-	-	-	20,262	5,000	1,472,000
15	31 FWR	87	309	1,743	-	-	-	-	-	2,031	4,612	22,986	-	-	-	-	-	27,598	20,700	2,747,000
16	8 FWR	28	227	883	-	-	-	-	-	678	1,578	8,277	-	-	-	-	-	9,855	4,000	1,222,400
18	2 FWR	10	43	138	-	-	-	-	-	233	460	2,897	-	-	-	-	-	3,357	4,900	251,000
19	8 FWR, 1 FWR&M-I	58	154	887	-	70	-	-	-	985	2,915	19,134	-	970	-	-	-	23,019	32,700	1,723,200
20	10 FWR	51	212	816	-	-	-	-	-	1,253	2,482	15,479	-	-	-	-	-	17,961	45,400	1,575,000
27	1 FWR	2	8	34	-	-	-	-	-	46	104	551	-	-	-	-	-	655	2,700	59,000
32	12 FWR	75	267	1,213	-	-	-	-	-	1,566	3,609	22,492	-	-	-	-	-	26,101	94,900	2,131,000
33	6 FWR, 1 FWR&M-I	51	75	642	-	133	-	-	-	497	2,536	14,115	-	2,000	-	-	-	18,651	36,100	1,221,500
40	22 FWR	91	226	1,335	-	-	-	-	-	1,755	4,188	22,527	-	-	-	-	-	26,715	74,900	2,008,500
44	15 FWR, 1 FWR&R, 1 FWR&M-I, 1 FWR&F.W.	84	197	2,230	190	42	300	-	-	866	3,654	25,484	4,946	507	1,581	-	-	36,172	89,800	1,955,500
45	10 FWR	20	84	543	-	-	-	-	-	396	841	4,397	-	-	-	-	-	5,238	13,300	783,000
51	47 FWR, 1 FWR&R	144	648	3,995	455	-	-	-	-	2,737	7,565	39,337	2,100	-	-	-	-	49,002	85,050	4,042,000
53	31 FWR, 2 FWR&R	113	572	2,960	77	-	-	-	-	2,867	5,605	30,099	651	-	-	-	-	36,355	66,100	2,701,000
56	7 FWR	185	429	2,101	-	-	-	-	-	3,549	8,161	46,707	-	-	-	-	-	54,868	53,400	2,168,000
58	5 FWR	16	107	468	-	-	-	-	-	352	680	3,924	-	-	-	-	-	4,604	11,600	366,000
59	9 FWR	66	193	1,232	-	-	-	-	-	1,443	2,778	18,454	-	-	-	-	-	21,232	17,100	1,321,000
62	25 FWR	69	316	1,401	-	-	-	-	-	1,324	2,694	17,620	-	-	-	-	-	20,314	66,300	1,578,000
63	10 FWR	112	306	1,642	-	-	-	-	-	2,155	4,370	30,027	-	-	-	-	-	34,397	118,000	2,365,000
64	8 FWR	31	119	609	-	-	-	-	-	585	1,188	7,711	-	-	-	-	-	8,899	35,400	787,000
70	36 FWR, 1 FWR&R	193	698	3,428	68	-	-	-	-	4,894	10,133	44,296	750	-	-	-	-	55,179	62,500	3,341,000
71	23 FWR	119	527	2,249	-	-	-	-	-	3,097	6,199	30,128	-	-	-	-	-	36,327	48,200	2,373,000
72	25 FWR, 1 FWR&R	149	513	3,409	420	-	-	-	-	2,936	7,602	40,845	5,000	-	-	-	-	53,447	60,400	3,507,000
73	35 FWR, 2 FWR&R	202	767	4,309	228	-	-	-	-	4,911	10,440	53,406	4,256	-	-	-	-	68,102	79,400	5,366,000
74	32 FWR, 1 FWR&R	89	491	2,342	74	-	-	-	-	2,298	4,852	24,273	424	-	-	-	-	29,549	59,200	2,347,000
75	15 FWR, 1 FWR&R	41	217	975	59	-	-	-	-	1,052	2,297	9,775	346	-	-	-	-	12,418	48,300	934,000
77	22 FWR, 1 FWR&R	83	354	1,867	86	-	-	-	-	2,136	4,562	22,610	617	-	-	-	-	27,789	53,800	2,364,000
78	25 FWR, 1 FWR&R	96	412	2,187	140	-	-	-	-	2,262	5,508	25,903	1,003	-	-	-	-	32,414	50,500	2,806,000
79	6 FWR	17	93	449	-	-	-	-	-	315	1,015	4,503	-	-	-	-	-	5,518	11,100	597,000
81	1 FWR	13	166	430	-	-	-	-	-	948	1,625	3,861	-	-	-	-	-	5,486	-	114,000
83	28 FWR, 1 FWR&R	125	575	3,034	256	-	-	-	-	3,726	6,890	34,189	5,309	-	-	-	-	46,388	120,700	3,362,000
84	20 FWR	64	384	1,706	-	-	-	-	-	2,023	4,044	16,495	-	-	-	-	-	20,539	46,700	1,699,000
85	1 FWR	6	27	120	-	-	-	-	-	169	341	1,688	-	-	-	-	-	2,029	8,000	235,000
92	15 FWR, 2 FWR&I, 1 FWR&M-I	111	292	2,651	-	68	-	344	-	2,202	5,706	37,706	-	1,001	-	2,621	-	47,034	70,000	2,838,000

TABLE 39 (CON.)

Watershed Nos.	Structural Measures and Purpose 1/	Drainage Area Controlled	Surface Area: Sediment Pool 50-Yr.	Surface Area: Flood Prevention Pool	Surface Area: Recreation Pool	Surface Area: Municip.& Indust. Pool	Surface Area: Fish & Wildlife Pool	Surface Area: Irrigation Pool	Surface Area: Water Qual. Control Pool	Storage: Sediment Pool 50-Yr.	Storage: Total Sediment 100-Yr.	Storage: Flood Prevention Pool	Storage: Recreation Pool	Storage: Municipal & Indust. Pool	Storage: Fish & Wildlife Pool	Storage: Irrigation Pool	Storage: Water Qual. Control Pool	Storage: Total	Remaining Storage	Volume of Fill
		(Sq.Mi.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(Ac.)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(A/F)	(Cu.Yd.)
94	22 FWR, 1 FWR&R, 1 FWR&M-I, 2 FWR&I	168	357	2,396	155	71	-	95	-	3,716	6,712	51,329	4,160	974	-	1,512	-	64,687	187,900	6,253,000
100	14 FWR, 1 FWR&R	138	306	2,662	315	-	-	-	-	3,374	5,618	49,490	3,583	-	-	-	-	58,691	54,900	4,792,700
101	12 FWR, 1 FWR&R, 1 FWR&M-I	76	138	1,395	204	36	-	-	-	2,375	3,330	22,295	2,433	502	-	-	-	28,560	38,900	2,198,000
102	2 FWR	14	55	465	-	-	-	-	-	238	484	3,982	-	-	-	-	-	4,466	-	202,000
103	4 FWR	24	107	910	-	-	-	-	-	493	910	8,043	-	-	-	-	-	8,953	18,400	383,000
104	17 FWR, 1 FWR&R	72	340	2,223	102	-	-	-	-	1,608	2,956	23,404	2,000	-	-	-	-	28,360	83,900	2,408,000
105	7 FWR	37	122	629	-	-	-	-	-	824	1,601	12,214	-	-	-	-	-	13,815	41,700	1,085,000
109	44 FWR	44	1,046	2,584	-	-	-	-	-	5,247	2/5,247	12,180	-	-	-	-	-	17,427	-	1,966,500
110	33 FWR	31	752	1,735	-	-	-	-	-	3,680	2/3,680	8,387	-	-	-	-	-	12,067	-	1,320,600
111	9 FWR	11	208	441	-	-	-	-	-	1,435	2/1,435	3,425	-	-	-	-	-	4,860	-	403,200
	Subtotal	3,810	15,287	79,051	2,829	946	640	634	245	94,229	194,086	1,073,763	37,578	9,663	5,577	6,133	6,885	1,333,685	2,364,775	102,693,100
Measures Outside Subwatershed Projects				Surcharge Pool (Ac.)								Surcharge Storage Pool (Ac.Ft.)								
9	1 M-I	6	-	60	-	40	-	-	-	-	340	408	-	1,019	-	-	-	1,767	5,000	160,000
22	1 R	4	-	108	88	-	-	-	-	-	225	496	1,331	-	-	-	-	2,052	3,400	287,000
35	1 R	5	-	192	176	-	-	-	-	-	254	614	2,929	-	-	-	-	3,797	4,600	190,000
36	1 R	1	-	34	27	-	-	-	-	-	49	119	54	-	-	-	-	222	1,300	31,000
47	2 R	8	-	187	167	-	-	-	-	-	354	619	3,199	-	-	-	-	4,172	8,700	339,000
48	1 R	3	-	78	73	-	-	-	-	-	122	212	1,979	-	-	-	-	2,313	2,200	91,000
57	3 R	14	-	332	289	-	-	-	-	-	779	1,584	5,659	-	-	-	-	8,022	13,400	1,003,000
77	1 R	2	-	66	60	-	-	-	-	-	83	185	994	-	-	-	-	1,262	1,100	151,000
	Subtotal	43	-	1,057	880	40	-	-	-	-	2,206	4,237	16,145	1,019	-	-	-	23,607	39,700	2,252,000
	Total	3,853	15,287	80,108	3,709	986	640	634	245	94,229	196,292	1,078,000	53,723	10,682	5,577	6,133	6,885	3/1,357,292	2,404,475	104,945,100

1/LEGEND: FWR - Floodwater Retarding
R - Recreation
M-I - Municipal & Industrial Water Supply
F.W. - Fish & Wildlife
I - Irrigation
WQ - Water Quality Control

2/100-year sediment quantities, except for watersheds 109, 110, and 111 where 50-year sediment was used.

3/Includes surcharge acre-feet.

TABLE 40

ESTIMATED COSTS AND BENEFITS
SOIL CONSERVATION SERVICE UPSTREAM WATERSHED PROJECTS

Watershed No.	Structural Measures and Purpose	Project Installation Costs 1/			Annual Costs			Annual Benefits (Dollar)	Benefit-Cost Ratio
		Federal	Non-Federal	Total	Amortiza'n of Installation Costs	Operation and Maintenance Costs	Total Annual Costs		
		(Dollar)							
1	30 FWR, 1 FWR&M-I	5,866,200	367,500	6,233,700	204,200	3,900	208,100	264,000	1.3:1
3	11 FWR, 1 FWR&WQ, 2 FWR&M-I	4,196,100	428,500	4,624,600	151,500	3,400	154,900	170,700	1.1:1
4	13 FWR, 1 FWR&I	2,036,400	122,000	2,158,400	70,700	2,400	73,100	136,700	1.9:1
6	21 FWR, 1 FWR&M-I	5,116,400	447,400	5,563,800	182,300	2,800	185,100	228,200	1.2:1
8	13 FWR, 1 FWR&F.W.	3,359,000	255,500	3,614,500	118,300	3,600	121,900	174,400	1.4:1
9	1 M-I	-	372,500	372,500	12,200	1,000	13,200	18,800	1.4:1
10	5 FWR	644,000	12,100	656,100	21,500	900	22,400	29,600	1.3:1
11	5 FWR, 1 FWR&M-I	1,649,700	219,700	1,869,400	61,200	1,200	62,400	95,500	1.5:1
15	31 FWR	3,805,200	265,600	4,070,800	133,400	5,700	139,100	172,500	1.2:1
16	8 FWR	1,698,700	118,100	1,816,800	59,500	1,600	61,100	80,600	1.3:1
18	2 FWR	323,400	9,200	332,600	10,900	400	11,300	17,900	1.6:1
19	8 FWR, 1 FWR&M-I	2,514,200	214,600	2,728,800	89,300	2,500	91,800	94,900	1.0:1
20	10 FWR	2,223,200	77,700	2,300,900	75,400	2,000	77,400	76,300	1.0:1
22	1 R	763,300	-	763,300	25,000	500	25,500	25,500	1.0:1
27	1 FWR	82,600	3,300	85,900	2,800	200	3,000	5,800	1.9:1
32	12 FWR	2,574,700	122,900	2,697,600	88,400	2,400	90,800	96,100	1.1:1
33	6 FWR, 1 FWR&M-I	1,507,000	237,300	1,744,300	57,100	1,800	58,900	102,600	1.7:1
35	1 R	774,500	-	774,500	25,400	500	25,900	25,900	1.0:1
36	1 R	141,700	-	141,700	4,600	200	4,800	4,800	1.0:1
40	22 FWR	2,639,200	106,400	2,745,600	90,000	4,400	94,400	134,200	1.4:1
44	15 FWR, 1 FWR&M-I, 1 FWR&F.W., 1 FWR&R, 7 Mi. CI 2/	2,393,950	430,050	2,824,000	92,600	7,300	99,900	248,500	2.5:1
45	10 FWR	929,600	47,600	977,200	32,000	1,800	33,800	67,900	2.0:1
47	2 R	1,518,700	-	1,518,700	49,800	1,000	50,800	50,800	1.0:1
48	1 R	695,600	-	695,600	22,800	500	23,300	23,300	1.0:1
51	47 FWR, 1 FWR&R	6,226,400	297,200	6,523,600	213,700	9,600	223,300	1,184,600	5.3:1
52	161 Mi. CI	1,537,500	1,241,800	2,779,300	91,000	65,700	156,700	685,200	4.4:1
53	31 FWR, 2 FWR&R, 190 Mi. CI	7,069,550	1,631,350	8,700,900	285,000	135,700	420,700	1,034,100	2.5:1
55	165 Mi. CI	1,690,900	926,600	2,617,500	85,700	73,800	159,500	705,800	4.4:1
56	7 FWR	2,618,000	163,500	2,781,500	91,100	20,000	111,100	402,500	3.6:1
57	3 R	2,458,800	-	2,458,800	80,600	1,500	82,100	82,100	1.0:1
58	5 FWR	481,600	41,500	523,100	17,200	1,000	18,200	54,400	3.0:1
59	9 FWR	1,799,000	105,200	1,904,200	62,400	1,800	64,200	176,400	2.7:1
62	25 FWR	2,186,800	124,300	2,311,100	75,700	3,900	79,600	204,200	2.6:1
63	10 FWR	2,648,800	105,900	2,754,700	90,200	2,600	92,800	264,000	2.8:1
64	8 FWR	956,200	47,800	1,004,000	32,900	1,700	34,600	96,100	2.8:1
66	38 Mi. CI	480,400	242,600	723,000	23,700	20,900	44,600	248,100	5.6:1
68	41 Mi. CI	183,400	107,600	291,000	9,500	8,100	17,600	38,600	2.2:1
70	36 FWR, 1 FWR&R	4,608,400	409,300	5,017,700	164,400	7,800	172,200	457,000	2.7:1
71	23 FWR	3,175,200	208,900	3,384,100	110,900	4,500	115,400	194,900	1.7:1
72	25 FWR, 1 FWR&R	4,269,300	341,500	4,610,800	151,100	6,300	157,400	264,300	1.7:1
73	35 FWR, 2 FWR&R	6,839,200	623,600	7,462,800	244,500	8,900	253,400	469,500	1.9:1
74	32 FWR, 1 FWR&R	3,265,800	262,700	3,528,500	115,600	6,200	121,800	324,200	2.7:1
75	15 FWR, 1 FWR&R	1,341,600	108,900	1,450,500	47,500	3,200	50,700	167,100	3.4:1
77	22 FWR, 1 FWR&R, 1 R	3,693,400	267,700	3,961,100	129,800	5,000	134,800	276,900	2.1:1
78	25 FWR, 1 FWR&R 3/	3,736,000	235,700	3,971,700	130,100	5,100	135,200	253,000	1.9:1
79	6 FWR 3/	814,800	39,800	854,600	28,000	1,200	29,200	38,600	1.3:1
81	1 FWR	146,100	40,800	186,900	6,100	200	6,300	20,000	3.1:1
82	25 Mi. CI	231,100	100,700	331,800	10,900	10,000	20,900	84,900	4.1:1
83	28 FWR, 1 FWR&R	4,246,600	476,900	4,723,500	154,800	6,400	161,200	231,200	1.4:1
84	20 FWR	2,252,600	178,900	2,431,500	79,700	3,600	83,300	97,400	1.2:1
85	1 FWR	280,000	13,100	293,100	9,600	200	9,800	22,600	2.3:1
88	121 Mi. CI	1,371,200	868,400	2,239,600	73,400	59,800	133,200	977,400	7.3:1
89	43 Mi. CI	526,700	347,500	874,200	28,600	22,900	51,500	267,500	5.2:1
90	74 Mi. CI	736,400	487,500	1,223,900	40,100	32,100	72,200	514,100	7.1:1
91	73 Mi. CI	676,800	384,300	1,061,100	34,800	29,500	64,300	668,700	10.4:1
92	15 FWR, 1 FWR&M-I, 2 FWR&I, 68 Mi. CI	5,215,300	1,293,600	6,508,900	213,200	81,500	294,700	531,200	1.8:1
94	22 FWR, 1 FWR&M-I, 2 FWR&I, 1 FWR&R	7,760,100	629,100	8,389,200	274,800	7,000	281,800	276,800	1.0:1
100	14 FWR, 1 FWR&R	6,978,100	405,300	7,383,400	241,900	3,100	245,000	211,800	0.9:1
101	12 FWR, 1 FWR&M-I, 1 FWR&R	2,610,600	281,700	2,892,300	94,800	4,400	99,200	247,200	2.5:1
102	2 FWR, 16 Mi. CI	819,300	196,100	1,015,400	33,300	14,400	47,700	185,400	3.9:1
103	4 FWR, 90 Mi. CI	2,576,300	1,316,600	3,892,900	175,500	93,000	268,500	400,400	1.5:1
104	17 FWR, 1 FWR&R, 46 Mi. CI	4,137,100	796,000	4,933,100	185,700	36,900	222,600	272,200	1.2:1

TABLE 40 (con.)

Watershed No.	Structural Measures and Purpose	Project Installation Costs 1/ Federal	Non-Federal	Total	Annual Costs Amortiza'n of Installation Costs	Operation and Maintenance Costs	Total Annual Cost	Annual Benefits (Dollar)	Benefit-Cost Ratio
		(Dollar)							
105	7 FWR, 55 Mi. CI	2,437,100	683,100	3,120,200	135,700	42,700	178,400	233,200	1.3:1
106	36 Mi. CI	447,000	287,500	734,500	24,100	19,500	43,600	57,400	1.3:1
108	15 Mi. CI	228,000	171,700	399,700	13,100	9,900	23,000	78,100	3.4:1
109	44 FWR, 179 Mi. CI	4,171,000	1,433,000	5,604,000	299,600	131,600	431,200	799,600	1.9:1
110	33 FWR, 183 Mi. CI	3,674,000	1,398,300	5,072,300	233,600	124,800	358,400	590,600	1.6:1
111	9 FWR, 140 Mi. CI	2,170,200	895,100	3,065,300	173,400	105,600	279,000	881,100	3.2:1
112	152 Mi. CI	1,700,400	843,100	2,543,500	160,400	91,300	251,700	985,800	3.9:1
113	166 Mi. CI	1,742,300	891,800	2,634,100	143,600	88,700	232,300	666,000	2.9:1
114	32 Mi. CI	442,900	204,900	647,800	30,300	21,300	51,600	108,000	2.1:1
115	138 Mi. CI	1,285,700	705,300	1,991,000	135,400	70,800	206,200	546,300	2.6:1
118	116 Mi. CI	1,537,200	885,600	2,422,800	195,800	92,800	288,600	1,522,100	5.3:1
119	189 Mi. CI	2,586,200	1,449,800	4,036,000	224,900	133,300	358,200	1,062,200	3.0:1
120	40 Mi. CI	615,600	298,600	914,200	42,900	29,700	72,600	151,600	2.1:1
121	18 Mi. CI	199,000	117,700	316,700	15,500	9,800	25,300	49,500	2.0:1
122	54 Mi. CI	920,000	473,000	1,393,000	45,600	40,000	85,600	236,200	2.8:1
123	35 Mi. CI	507,700	240,300	748,000	24,500	22,100	46,600	202,200	4.3:1
124	110 Mi. CI	1,460,100	768,800	2,228,900	260,900	57,300	318,200	893,400	2.8:1
125	211 Mi. CI	2,723,100	1,294,600	4,017,700	377,100	79,200	456,300	1,685,500	3.7:1
127	133 Mi. CI	1,452,900	694,600	2,147,500	140,000	35,800	175,800	585,000	3.3:1
128	124 Mi. CI	1,253,900	646,800	1,900,700	151,100	40,200	191,300	672,900	3.5:1
130	49 Mi. CI	1,036,300	565,000	1,601,300	52,500	45,000	97,500	465,400	4.8:1
132	106 Mi. CI	4,253,300	2,179,700	6,433,000	210,700	184,700	395,400	1,773,400	4.5:1
133	55 Mi. CI	1,413,800	796,100	2,209,900	72,400	61,400	133,800	871,100	6.5:1
B	23 Mi. CI	400,400	270,400	670,800	32,200	19,700	51,900	52,500	1.0:1
TOTAL		188,756,800	37,402,700	226,159,500	8,814,000	2,408,700	11,222,700	30,145,000	2.7:1

LEGEND:
- **FWR - Floodwater Retarding**
- **M-I - Municipal & Industrial Water Supply**
- **R - Recreation**
- **F.W. - Fish & Wildlife**
- **WQ - Water Quality Control**
- **I - Irrigation**
- **CI - Channel Improvement**

1/Price Base - 1965.

2/Six miles of channel improvement for flood prevention only.
One mile of multipurpose channel.

3/To be considered if Water Valley Dam is eliminated.

programs, the costs of providing surface water storage for water supply is a non-Federal responsibility, except in hardship areas such as Subwatershed No. 94 where some Federal cost-sharing may be possible. The improvements would be installed when non-Federal interests are prepared to assume their responsibility. It is estimated that the program for water supply storage in the upstream areas can be installed in 10 to 15 years.

(b) Cost. Using the 1965 price base, the total estimated installation cost of the above listed 11 structures allocated to municipal and industrial storage is $1,051,000. The total estimated annual cost of these measures allocated to municipal and industrial storage, including $5,500 annual operation and maintenance costs, would be $39,900.

(c) Benefits. Water supply benefits would accrue from increased quantities of water made available as the result of the installation of the planned reservoirs. These benefits were determined on the basis of obtaining water of equal quantity and quality from the least costly alternative. On the basis of prices prevailing in 1965, average annual costs were estimated to be $39,900 and average annual benefits were estimated to be $80,700. The benefit-to-cost ratio was 2.0:1.

(d) Cost sharing. Local interests would be required to assume all of the costs allocated to municipal and industrial storage except in Subwatershed No. 94. Accordingly, non-Federal interests would be required to start repayment of the estimated first cost of $991,100 allocated to water supply at such time as the stored waters are first used. The Federal share of first costs in Subwatershed No. 94 is $59,900. Local interests would be required to provide all lands, easements, rights-of-way, and relocations necessary for the installation of these multiple-purpose structures. Local interests also would be required to operate and maintain the improvements after completion.

(3) Recreation.

(a) Structural measures.

1. The future demand for public recreation in the basin is estimated to be 9,500,000 recreation days by the year 1980. Much of this demand will center on the available water-based developments. Studies indicate that all feasible water-based recreation developments in the basin will be utilized to the maximum extent.

2. Recreation storage is needed and feasible in 17 potential multiple-purpose floodwater retarding and recreation reservoirs located in Subwatersheds Nos. 44, 51, 53, 70, 72, 73, 74, 75, 77, 78, 83, 94, 100, 101, and 104.

3. On non-Federal lands, the provision of recreation in upstream structures would be a local undertaking with Federal financial and technical assistance. The improvements would be installed when local interests are prepared to assume their responsibilities. It is estimated that this element of the program for recreation development can be installed in 10 to 15 years.

(b) Cost. Using the 1965 price base, the total estimated installation cost of the above listed 17 structures allocated to recreation storage is $5,089,300 of which $3,184,300 would be borne by Federal funds and $1,905,300 by non-Federal funds. The total estimated annual cost of these measures allocated to recreation, including $10,100 annual operation and maintenance costs, would be $176,800.

(c) Benefits.

1. The evaluation of recreation and incidental recreational benefits was limited to those expected to accrue to organized groups or the general public. These benefits were based on the value of a recreation-day, and the estimated number of recreation-days was based on secondary data and field surveys made for similar areas by Soil Conservation Service biologists. The Bureau of Outdoor Recreation for the Southeast Region supplied data and assistance in developing information for establishing dollar value for both the recreation and incidental recreation benefits.

2. On the basis of prices prevailing in 1965, average annual costs allocated to recreation were estimated to be $176,800 and average annual benefits were estimated to be $590,600. The benefit-to-cost ratio was 3.3:1.

(d) Cost sharing. The Use of Facilities method for determining cost allocation was used. The Federal share would be 50 percent of construction cost, land, easements, rights-of-way, and minimum basic facilities, and all of the installation services costs. The non-Federal cost would be all of the administration, water rights, and 50 percent of the construction, land, easements, rights-of-way, and minimum basic facilities costs, and all of the operation and maintenance costs. Cost sharing of land rights for the 17 multiple-purpose structures is listed in Table 41.

(4) Irrigation.

(a) Structural measures. The timely use of irrigation water to supplement rainfall greatly increases yields of crops grown in the area. The availability of a dependable supply of moisture enables the farmer to use increased amounts of fertilizers and other practices which greatly increase yields and net income. Irrigation storage was provided in 5 multiple-purpose floodwater retarding and irrigation structures in Subwatersheds Nos. 4, 92, and 94. An estimated 3,066 acres will be provided irrigation water from these structures.

TABLE 41

COST SHARING-LAND RIGHTS FOR PUBLIC RECREATION DEVELOPMENTS
DEPARTMENT OF AGRICULTURE UPSTREAM WATERSHED PROGRAM

Watershed Number	Number of Structures	Structures			Basic Facilities			Total
		Federal	Non-Fed.	Total	Federal	Non-Fed.	Total	
		(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)
8	1 FWR & F.W. - Multipurpose	18,000	18,000	36,000	2,000	2,000	4,000	40,000
44	1 FWR & F.W. "	9,000	9,000	18,000	-	4,000	4,000	22,000
Total	2 FWR & F.W. "	27,000	27,000	54,000	2,000	6,000	8,000	62,000
44	1 FWR & R - Multipurpose	7,450	7,450	14,900	200	200	400	15,300
51	1 FWR & R 1/ "	80,800	-	80,800	39,000	-	39,000	119,800
53	2 FWR & R 1/ "	5,000	-	5,000	16,300	-	16,300	21,300
70	1 FWR & R "	20,400	20,400	40,800	1,000	1,000	2,000	42,800
72	1 FWR & R "	44,250	44,250	88,500	5,000	5,000	10,000	98,500
73	2 FWR & R "	36,500	36,500	73,000	3,000	3,000	6,000	79,000
74	1 FWR & R "	13,700	13,600	27,300	-	600	600	27,900
75	1 FWR & R "	7,250	7,250	14,500	-	600	600	15,100
77	1 FWR & R "	17,100	17,100	34,200	200	200	400	34,600
78	1 FWR & R "	21,000	21,000	42,000	500	500	1,000	43,000
83	1 FWR & R 2/ "	37,600	25,400	63,000	6,000	-	6,000	69,000
94	1 FWR & R "	12,500	12,500	25,000	5,000	5,000	10,000	35,000
100	1 FWR & R "	51,000	51,000	102,000	2,000	2,000	4,000	106,000
101	1 FWR & R "	23,000	23,000	46,000	1,000	1,000	2,000	48,000
104	1 FWR & R "	15,000	15,000	30,000	500	500	1,000	31,000
Total	17 FWR & R "	392,550	294,450	687,000	79,700	19,600	99,300	786,300
Structures on National Forest Land								
22	1 R - Single Purpose	7,200	-	7,200	7,000	-	7,000	14,200
35	1 R " "	16,300	-	16,300	12,000	-	12,000	28,300
36	1 R " "	2,000	-	2,000	10,000	-	10,000	12,000
47	2 R " "	23,300	-	23,300	3,600	-	3,600	26,900
48	1 R " "	4,800	-	4,800	-	-	-	4,800
57	3 R " "	30,600	-	30,600	15,100	-	15,100	45,700
77	1 R " "	4,600	-	4,600	20,000	-	20,000	24,600
Total	10 R " "	88,800	-	88,800	67,700	-	67,700	156,500

LEGEND: FWR - Floodwater Retarding
F.W. - Fish & Wildlife
R - Recreation

1/Structure located on National Forest Land.
2/Structure located in hardship area.

(b) Cost. Using the 1965 price base, the total estimated installation cost of the 5 structures allocated to irrigation is $524,600 of which $255,700 would be borne by Federal funds and $268,900 by non-Federal funds. The total estimated annual cost allocated to irrigation, including $1,400 annual operation and maintenance costs, would be $18,500.

(c) Benefits. The increased net income from the larger yields resulting from irrigating the crops presently grown in the areas was used as a benefit. Corn, truck, sorghum silage, and alfalfa are the main crops which would be irrigated. On the basis of prices prevailing in 1965, average annual costs of the 5 structures allocated to irrigation were estimated to be $18,500 and average annual benefits were estimated to be $67,800. The benefit-to-cost ratio was 3.7:1.

(d) Cost sharing. Federal funds would bear 50 percent of the construction costs of the multiple-purpose storage reservoirs allocated to irrigation and all of the installation services costs. The non-Federal costs would be 50 percent of the construction costs and all of the land, easements, rights-of-way, administration of contracts, water rights, and all of the operation and maintenance costs. Total installation cost of the 5 impoundment-type structures allocated to irrigation is $524,600 of which $255,700 would be borne by Federal funds and $268,900 by non-Federal funds. Total estimated annual cost allocated to irrigation, including $1,400 annual operation and maintenance costs, would be $18,500. Estimated total annual benefits would be $67,800.

(5) Fish and wildlife.

(a) Structural measures. This segment of the plan provides for 2 multiple-purpose floodwater retarding and fish and wildlife structures, located in Subwatersheds Nos. 8 and 44.

(b) Cost. Using the 1965 price base, the total estimated installation cost of the 2 structures allocated to fish and wildlife is $702,900 of which $392,600 would be borne by Federal funds, and $310,300 by non-Federal funds. The total estimated annual cost of these measures allocated to fish and wildlife, including $1,300 annual operation and maintenance costs, would be $24,300.

(c) Benefits. The evaluation of benefits was limited to those expected to accrue to organized groups or the general public. These benefits were based on the value of a visitor day-of-use and the estimated number of visitor days-of-annual-use was based on secondary data and field surveys made for similar areas by Soil Conservation Service biologists. On the basis of prices prevailing in 1965, average annual costs allocated to fish and wildlife were estimated to be $24,300 and average annual benefits were estimated to be $118,600. The benefit-to-cost ratio was 4.9:1.

(d) Cost sharing. The Use of Facilities method for determining cost allocation was used. The Federal share would be 50 percent of construction cost, land, easements, rights-of-way, and minimum basic facilities, and all of the installation services costs. The non-Federal cost would be all of the administration, water rights, and 50 percent of the construction, land, easements, rights-of-way, and minimum basic facilities costs, and all of the operation and maintenance costs.

(6) Water quality control.

(a) Structural measures.

1. Storage to provide for water quality control is particularly needed during prolonged drought periods. Even with acceptable levels of waste treatment, certain materials that affect the hydrologic and biologic balance of the West Fork of the White River below Fayetteville, Arkansas, will adversely affect the use of the upper reaches of Beaver Reservoir for domestic, industrial, fish and wildlife, and recreation purposes. Population growth in this area is expected to increase the need for quality control. The appearance of the stream, its ability to maintain aquatic life, and use for recreation may be greatly enhanced during drought periods by releases from upstream reservoirs.

2. Storage capacity for streamflow augmentation needs was based on the releases from the reservoir needed to maintain adequate streamflow for acceptable quality of water under conditions expected to prevail with the estimated development of the upstream areas to the year 1980. For quality studies, the base flow of the stream was considered to be the low natural runoff, prior to development, expected to be exceeded 95 percent of the time (once in 20 years drought recurrence interval).

3. The plan for streamflow augmentation was formulated so as to obtain a minimum acceptable level of water quality. This determination was made on the basis of water quality levels expected to prevail after the installation of the highest practical level of waste treatment measures. Accordingly, storage for streamflow augmentation is not provided in lieu of waste treatment.

4. The plan provides for storage of water for streamflow augmentation in one multiple-purpose floodwater retarding and water quality control structure in Subwatershed No. 3. Gated or regulated releases will be provided. The improvement would be installed when local interests are prepared to assume their responsibilities. An immediate need exists for streamflow augmentation.

(b) Cost. Using the 1965 price base, the total estimated installation cost of this structure allocated to water quality control is $997,800 of which $909,700 would be borne by Federal funds, and $88,100 by non-Federal funds. The total estimated annual cost allocated to water quality control, including $800 annual operation and maintenance costs, would be $33,500.

(c) Benefits. Water quality control benefits would accrue from improving the quality of water in the upstream area during periods of low natural streamflow. These benefits were determined on the basis of obtaining water of equal quantity and quality from the least costly alternative. Incidental benefits would accrue to recreation, and fish and wildlife. Average annual costs allocated to water quality control were estimated to be $33,500 and average annual primary benefits were estimated to be $40,300.

(d) Cost sharing.

1. The Federal Water Pollution Control Act, as amended, 33 USC. 466 et seq., provides that the costs of water quality control features incorporated in any Federal reservoir shall be determined and the beneficiaries identified. However, when the benefits are widespread or national in scope, the costs of such features are nonreinbursable.

2. It is proposed that the sharing of costs for water quality control in the upstream reservoir in the White River Basin be on the same basis as that provided for Federal reservoirs in the Federal Water Pollution Control Act. The benefits which accrue from this feature are, for the most part, downstream from the subwatershed in which storage would be developed. The benefits from the provision of storage for streamflow regulation for water quality control are widespread in scope and specific beneficiaries are not identifiable.

3. All of the construction and installation services costs for the provision of storage for streamflow regulation would be borne by the Federal Government. Non-Federal interests would be required to furnish land, easements and rights-of-way, administration of contracts, and water rights.

4. Prior to the installation of this reservoir, the Secretary of Agriculture would consult with the Commissioner of the Federal Water Pollution Control Administration to determine whether modification of the proposed storage for streamflow regulation for water quality control is needed in view of possible changed requirements since the formulation of the plan.

d. Subwatershed projects, multiple-purpose flood prevention and agricultural water management channels.

(1) Channel improvements.

(a) Potentially feasible structural measures consist of 3,511 miles of channel improvement proposed in 39 subwatersheds. The locations of the principal channels are shown on the Potential Works of Improvement Maps, and pertinent data are summarized by subwatersheds in Table 42. Studies have shown that these measures are needed to solve urgent flood and other related water management problems through 1980.

(b) In the 29 subwatersheds in which only channel improvement is proposed, benefits from drainage were calculated on a total of 1,223,389 acres. In the 10 subwatersheds in which impoundment-type structures and channel improvement were planned, benefits were calculated on 308,459 acres. Acres benefited were not separated due to overlapping of purposes.

(2) Cost. Total installation cost of the 3,511 miles of channels, including 14,058 grade stabilization structures, would be $75,868,400 of which $49,427,900 would be borne by Federal funds and $26,440,500 by non-Federal funds. The total estimated annual cost of these multiple-purpose flood prevention and agricultural water management channel improvement measures, including $2,197,400 annual operation and maintenance costs, would be $6,196,800. Estimated total annual benefits would be $18,686,900. The benefit-to-cost ratio would be 3.3:1. Multiple-purpose channel improvement benefits and costs are listed in Tables 43 and 44.

(3) Cost sharing. The costs of the multiple-purpose ditches were allocated 50 percent to flood prevention and 50 percent to agricultural water management. The Federal costs would be all of the construction and installation services costs allocated to flood prevention and 50 percent of the construction and all of the installation services costs allocated to agricultural water management. The non-Federal costs would be 50 percent of the construction costs allocated to agricultural water management and all of the land, easements, rights-of-way, and administration of contracts for the entire project.

e. Measures outside subwatershed projects upstream structural measures.

(1) Single-purpose recreation. This segment of the plan provides for 10 single-purpose recreation sites located in National Forest areas. Nine of these sites are located in Subwatersheds Nos. 22, 35, 36, 47, 48, and 57 where subwatershed project-type structural measures are not planned. The one remaining single-purpose recreation site is located in Subwatershed No. 77 which is inside a subwatershed project area.

TABLE 42

STRUCTURE DATA - MULTIPLE PURPOSE CHANNELS

SOIL CONSERVATION SERVICE UPSTREAM WATERSHED PROJECTS

Watershed No.	Length of Channel Improvement (Miles)	Total Drainage Area (Sq.Mi.)	Drainage Area Controlled by Structures (Sq.Mi.)	Structure Release Rate (c.f.s.)	Channel Excavation (Cu.Yd.)	Grade Stabilization Structures (Number)
44	1	174	-	-	12,000	-
52	161	155	-	-	3,245,000	220
53	190	343	113	1,694	7,969,000	126
55	165	97	-	-	3,146,000	162
66	38	42	-	-	1,141,000	40
68	41	20	-	-	385,000	47
82	25	42	-	-	619,000	-
88	121	167	-	-	2,330,000	498
89	43	43	-	-	1,095,000	166
90	74	106	-	-	1,330,500	308
91	73	130	-	-	1,370,000	250
92	68	350	111	557	5,142,500	380
102	16	61	-	-	532,400	89
103	90	241	24	284	3,904,600	499
104	46	157	72	869	1,210,900	231
105	55	194	37	444	1,409,800	264
106	36	182	-	-	600,200	158
108	15	254	-	-	364,500	67
109	179	274	44	853	4,670,000	855
110	183	251	31	415	5,190,000	861
111	140	160	11	165	3,570,000	732
112	152	166	-	-	3,312,800	712
113	166	183	-	-	3,151,500	828
114	32	35	-	-	920,000	160
115	138	199	-	-	2,211,000	534
118	116	190	-	-	2,987,000	617
119	189	329	-	-	5,219,500	896
120	40	44	-	-	1,429,500	182
121	18	17	-	-	392,000	76
122	54	47	-	-	1,825,200	290
123	35	33	-	-	1,027,600	179
124	110	166	-	-	2,664,300	502
125	211	280	-	-	5,047,100	874
127	133	284	-	-	2,718,700	525
128	124	133	-	-	2,153,600	449
130	49	300	-	-	2,119,500	284
132	106	256	-	-	10,693,200	539
133	55	135	-	-	3,067,900	312
B	23	70	-	-	690,000	146
Total	3,511	6,310	443	5,281	100,867,800	14,058

TABLE 43

SUMMARY OF COSTS AND BENEFITS BY PURPOSES
SOIL CONSERVATION SERVICE UPSTREAM WATERSHED PROJECTS

Item	Federal Cost (Dollar)	Non-Federal Cost (Dollar)	Total Installation Cost (Dollar)	Annual Amortization Cost (Dollar)	Annual Opera.&Maint. Cost (Dollar)	Total Annual Cost (Dollar)	Total Annual Benefits (Dollar)	Average Benefit-Cost Ratio
Subwatershed Projects								
Flood Prevention Purpose:								
849 Structures + 6 miles Channel Improvement	127,764,400	7,026,300	134,790,700	4,306,900	186,500	4,493,400	10,311,000	2.3:1
Purposes other than Flood Prevention in Multipurpose Structures:								
Municipal & Industrial Storage - 11 Sites	59,900	991,100	1,051,000	34,400	5,500	39,900	80,700	2.0:1
Recreation Storage - 17 Sites	3,184,300	1,905,000	5,089,300	166,700	10,100	176,800	590,600	3.3:1
Irrigation Storage - 5 Sites	255,700	268,900	524,600	17,100	1,400	18,500	67,800	3.7:1
Fish & Wildlife Storage - 2 Sites	392,600	310,300	702,900	23,000	1,300	24,300	118,600	4.9:1
Water Quality Control - 1 Site	909,700	88,100	997,800	32,700	800	33,500	44,300	1.3:1
Subtotal (Impoundment-Type Structures)	132,566,600	10,589,700	143,156,300	4,580,800	205,600	4,786,400	11,213,000	2.4:1
Multipurpose Flood Prevention & Agricultural Water Management Channel Improvement - 3,511 miles	49,427,900	26,440,500	75,868,400	3,999,400	2,197,400	6,196,800	18,686,900	3.3:1
Total - Subwatershed Projects	181,994,500	37,030,200	219,024,700	8,580,200	2,403,000	10,983,200	29,899,900	2.7:1
Measures Outside Subwatershed Projects								
Single Purpose Recreation - 10 Sites	6,762,300	-	6,762,300	221,600	4,700	226,300	226,300	1.0:1
Single Purpose Municipal & Industrial - 1 Site	-	372,500	372,500	12,200	1,000	13,200	18,800	1.4:1
Subtotal	6,762,300	372,500	7,134,800	233,800	5,700	239,500	245,100	-
Grand Total - All Projects	188,756,800	37,402,700	226,159,500	8,814,000	2,408,700	11,222,700	30,145,000	2.7:1

TABLE 44
PROJECT BENEFITS - SUMMARY OF DRAINAGE BENEFITS AND COSTS
SOIL CONSERVATION SERVICE UPSTREAM WATERSHEDS

Watershed No.	Channel Improv. (Mi.)	Area 1/ Benefited (Ac.)	Drainage	Redevelopment	Secondary	Total 2/ Annual Benefits	Total 3/ Annual Costs	Benefit-Cost Ratio
			(Dollars)					
44	1	725	4,300	-	400	4,700	300	14.9:1
52	161	61,580	295,200	-	29,500	324,700	78,300	4.1:1
53	190	62,907	238,900	-	23,900	262,800	140,500	1.9:1
55	165	47,808	301,700	-	30,200	331,900	79,700	4.2:1
66	38	16,000	107,200	800	10,700	118,700	22,300	5.3:1
68	41	8,640	16,500	300	1,700	18,500	8,800	2.1:1
82	25	9,754	38,100	600	3,800	42,500	10,500	4.1:1
88	121	83,366	441,400	3,200	44,100	488,700	66,600	7.3:1
89	43	21,190	120,500	1,200	12,000	133,700	25,700	5.2:1
90	74	50,880	232,100	1,800	23,200	257,100	36,100	7.1:1
91	73	62,400	300,800	3,400	30,100	334,300	32,100	10.4:1
92	68	28,821	106,800	5,500	10,700	123,000	89,400	1.4:1
102	16	11,525	55,200	1,200	5,500	61,900	11,600	5.4:1
103	90	8,136	28,100	-	2,800	30,900	20,300	1.5:1
104	46	2,344	7,200	-	-	7,200	6,000	1.2:1
105	55	2,918	13,500	-	-	13,500	10,400	1.3:1
106	36	2,580	12,900	-	2,600	15,500	11,900	1.3:1
108	15	7,000	33,900	-	3,400	37,300	11,500	3.2:1
109	179	86,451	294,300	7,400	-	301,700	175,100	1.7:1
110	183	50,278	240,100	10,000	-	250,100	151,600	1.6:1
111	140	54,354	413,500	6,300	-	419,800	131,600	3.2:1
112	152	57,458	466,700	2,900	-	469,600	125,800	3.7:1
113	166	42,617	314,300	3,000	-	317,300	116,200	2.7:1
114	32	6,713	50,700	800	-	51,500	25,800	2.0:1
115	138	52,322	258,100	2,200	-	260,300	103,100	2.5:1
118	116	86,694	722,300	2,600	-	724,900	144,300	5.0:1
119	189	69,047	501,600	4,400	-	506,000	179,100	2.8:1
120	40	9,615	71,200	1,000	-	72,200	36,300	2.0:1
121	18	3,809	23,400	200	-	23,600	12,600	1.9:1
122	54	16,544	107,400	-	10,700	118,100	42,800	2.8:1
123	35	12,695	91,900	-	9,200	101,100	23,300	4.3:1
124	110	44,843	406,100	-	40,600	446,700	159,100	2.8:1
125	211	112,569	762,200	4,400	76,200	842,800	228,200	3.7:1
127	133	116,879	262,800	3,400	26,300	292,500	87,900	3.3:1
128	124	49,710	305,800	-	30,600	336,400	95,700	3.5:1
130	49	43,660	202,300	-	20,300	222,600	48,800	4.7:1
132	106	65,536	502,300	-	50,200	552,500	197,700	2.8:1
133	55	52,480	365,300	-	36,500	401,800	66,900	6.0:1
B	23	9,000	22,800	-	2,300	25,100	26,000	1.0:1
Basin Total	3,511	1,531,848	8,739,400	66,600	537,500	9,343,500	2,839,900	3.3:1

1/Area on which monetary benefits were claimed.
2/Adjusted normalized prices.
3/Price base: 1965.

(a) Cost. Using the 1965 price base, the total estimated installation cost of these 10 recreation structures is $6,762,300, all of which would be borne by Federal funds, as these structures would be located on Federal land. The total estimated annual cost of these measures, including $4,700 annual operation and maintenance costs, would be $226,300.

(b) Benefits. These projects are located in areas where it has been determined by the Forest Service that an unfilled need will exist for recreation in 10 to 15 years. Evaluation of recreation benefits was limited to those expected to accrue to organized groups or the general public. These benefits were assumed to be equal to the total annual costs at the time of construction within the 10- to 15-year period. On the basis of prices prevailing in 1965, average annual costs were estimated to be $226,300 and average annual benefits were estimated to be the same. The benefit-to-cost ratio would therefore be 1:0.1. Recreation benefits and costs are listed in Table 45.

TABLE 45

SUMMARY OF RECREATION BENEFITS AND COSTS IN SINGLE-PURPOSE FOREST SERVICE STRUCTURES

Watershed number	Recreation structures	Recreation benefits (1)	Total annual costs
22	1	$25,500	$25,500
35	1	25,900	25,900
36	1	4,800	4,800
47	2	50,800	50,800
48	1	23,300	23,300
57	3	82,100	82,100
77	1	13,900	13,900
Total	10	226,300	226,300

(1) Recreation benefits were assumed to equal the cost.

(c) Cost sharing. These 10 structures would be located on Federal land and are designed to fill a need for recreation, therefore, all costs including operation and maintenance are assigned to Federal costs. Cost sharing for these 10 single-purpose recreation structures is listed in Table 47 which is presented later in this section.

(2) Single-purpose municipal and industrial (water supply). A single-purpose municipal and industrial water-storage site for Berryville, Arkansas, is located in Subwatershed No. 9.

(a) Cost. Using the 1965 price base, the total estimated installation cost of this structure is $372,500, all of which would be borne by local interests. The total estimated annual cost of this measure, including $1,000 annual operation and maintenance costs, would be $13,200 and would also be borne by local interests.

(b) Benefits. The benefits were determined on the basis of obtaining water of equal quantity and quality from the least costly alternative. The cost of installing and maintaining a pipeline to an adequate source of water, which in this case is Table Rock Reservoir, is more expensive. Ground water from wells cannot be obtained in sufficient quantity in this area. The nearby floodwater retarding reservoir sites do not have adequate yield, or their watershed include drainage from Berryville's sewage disposal plant. The total annual benefits are estimated to be $18,800. The benefit-to-cost ratio is 1.4:1.

(c) Cost sharing. Current cost sharing criteria does not provide for Federal cost sharing in single-purpose municipal and industrial water supply structures.

32. SUMMARY - U. S. DEPARTMENT OF AGRICULTURE STRUCTURAL PLAN OF DEVELOPMENT IN THE 10- TO 15-YEAR PLAN

a. Costs and benefits.

(1) The total installation cost of the 849 impoundment-type structures and 6 miles of flood prevention channel improvement in subwatershed-type projects is estimated to be $143,156,300 of which $132,566,600 would be borne by Federal funds and $10,589,700 by non-Federal funds. The total estimated annual cost of these measures, including $205,600 annual operation and maintenance costs, would be $4,786,400. Estimated total annual benefits would be $11,213,000. The benefit-to-cost ratio would be 2.4:1.

(2) The total installation cost of 3,511 miles of multiple-purpose flood prevention and agricultural water management channels in subwatershed-type projects is estimated to be $75,868,400 of which $49,427,900 would be borne by Federal funds and $26,440,500 by non-Federal funds. The total estimated annual cost of these measures, including $2,197,400 annual operation and maintenance costs, would be $6,196,800. Estimated total annual benefits would be $18,686,900. The benefit-to-cost ratio would be 3.3:1.

(3) The total installation cost of the 10 single-purpose recreation sites is estimated to be $6,762,300, all of which will be borne by Federal funds. The total estimated annual cost of these measures, including $4,700 annual operation and maintenance costs, would be $226,300. The annual benefits were estimated to equal the costs. The total installation cost of one single-purpose municipal and industrial site is estimated to be $372,500, all of which would be borne by

non-Federal funds. The total estimated annual cost of this site, including $1,000 annual operation and maintenance, would be $13,200. The estimated total annual benefits would be $18,800. Benefit-to-cost ratio would be 1.4:1.

(4) The total installation cost of all program structural measures consisting of 860 impoundment-type structures and 3,517 miles of channel improvement would be $226,159,500 of which $188,756,800 would be borne by Federal funds and $37,402,700 by non-Federal funds. The total estimated annual cost of these measures, including $2,408,700 annual operation and maintenance costs, would be $11,222,700. Estimated total annual benefits would be $30,145,000. The benefit-to-cost ratio would be 2.7:1.

(5) Project installation costs, annual costs and benefits, and benefit-to-cost ratios are listed in Table 40, by subwatersheds, for all structural measures included in the 10- to 15-year plan. Tables 46, 47, and 48 summarize costs and cost sharing by purposes, project benefits, and benefited areas. Table 48 lists individual watershed project benefits by types, and the project totals summarize these benefits by purposes from Tables 44, 45, and 48.

(6) The subwatershed numbers and selected 10- to 15-year plan structural measures are listed in Table 40. Subwatershed locations are shown on the Basin Reach Map, Plate P-20, and on Potential Works of Improvement Maps, Plates 21 to 46, inclusive.

b. <u>Structure pertinent data.</u>

(1) The general features of all upstream structures in the 10- to 15-year plan, both within and outside subwatershed projects, are outlined in Table 38. Planned floodwater detention storage in 849 of the 860 potential structures listed in the 10- to 15-year plan ranges from about 4.3 to 7.5 watershed inches above the estimated 3,810 square miles of controlled areas above the 849 structures, and averages about 5.2 inches. All planned structures except the 10 single-purpose recreation sites and one single-purpose municipal and industrial site, after allowance for a 15 cubic feet per second per square mile floodwater release rate, would store the 25-, 50-, or 100-year frequency runoff volumes or intermediate volumes between the 25- to 100-year volumes, depending upon structure classification and importance. These storage volumes are based on regional analysis of gaged runoff.

(2) Total storage capacity of the 860 potential impoundment-type structures included in the 10- to 15-year plan is 1,357,292 acre-feet. Storage by purposes is as follows: 196,292 acre-feet for sediment accumulation over a 100-year period; 1,073,763 acre-feet for floodwater detention; 10,682 acre-feet for municipal and industrial; 6,133 acre-feet

TABLE 46
COST ALLOCATION BY PURPOSES
SOIL CONSERVATION SERVICE UPSTREAM WATERSHED PROJECTS

Watershed Number	Total Structural Measures	Single Purpose				Multiple Purpose							
		Flood Prevention	Recreation	Municipal & Industrial	Total	Flood Prevention	Recreation	Recreation & Fish & Wildlife	Water Quality Control	Municipal & Industrial	Drainage	Irrigation	Total
						(Dollars)							
1	6,233,660	5,672,160	-	-	5,672,160	503,990	-	-	-	57,510	-	-	561,500
2	No Struct.												
3	4,624,600	2,147,600	-	-	2,147,600	1,343,710	-	-	997,790	135,500	-	-	2,477,000
4	2,158,450	1,536,450	-	-	1,536,450	531,150	-	-	-	-	-	90,850	622,000
5	No Struct.												
6	5,563,800	4,903,850	-	-	4,903,850	462,900	-	-	-	197,050	-	-	659,950
7	No Struct.												
8	3,614,500	2,413,500	-	-	2,413,500	734,700	-	466,300	-	-	-	-	1,201,000
9	372,500	-	-	372,500	372,500	-	-	-	-	-	-	-	-
10	656,100	656,100	-	-	656,100	-	-	-	-	-	-	-	-
11	1,869,400	1,693,240	-	-	1,693,240	125,970	-	-	-	50,190	-	-	176,160
12	Long-range												
13	No Struct.												
14	Long-range												
15	4,070,800	4,070,800	-	-	4,070,800	-	-	-	-	-	-	-	-
16	1,816,800	1,816,800	-	-	1,816,800	-	-	-	-	-	-	-	-
17	No Struct.												
18	332,600	332,600	-	-	332,600	-	-	-	-	-	-	-	-
19	2,728,800	1,769,800	-	-	1,769,800	851,600	-	-	-	107,400	-	-	959,000
20	2,300,900	2,300,900	-	-	2,300,900	-	-	-	-	-	-	-	-
21	No Struct.												
22	763,300	-	763,300	-	763,300	-	-	-	-	-	-	-	-
23	Long-range												
24	No Struct.												
25	No Struct.												
26	Long-range												
27	85,900	85,900	-	-	85,900	-	-	-	-	-	-	-	-
28	PL-566												
29	Long-range												
30	No Struct.												
31	No Struct.												
32	2,697,580	2,697,580	-	-	2,697,580	-	-	-	-	-	-	-	-
33	1,744,350	1,096,050	-	-	1,096,050	510,290	-	-	-	138,010	-	-	648,300
34	No Struct.												
35	774,500	-	774,500	-	774,500	-	-	-	-	-	-	-	-
36	141,700	-	141,700	-	141,700	-	-	-	-	-	-	-	-
37	Long-range												
38	Long-range												
39	Long-range												
40	2,745,560	2,745,560	-	-	2,745,560	-	-	-	-	-	-	-	-
41	Long-range												
42	No Struct.												
43	No Struct.												
44	2,823,950	1,470,850	-	-	1,470,850	776,930	301,000	236,600	-	36,800	1,770	-	1,353,100
45	977,200	977,200	-	-	977,200	-	-	-	-	-	-	-	-
46	PL-566												
47	1,518,700	-	1,518,700	-	1,518,700	-	-	-	-	-	-	-	-
48	695,600	-	695,600	-	695,600	-	-	-	-	-	-	-	-
49	Long-range												
50	Long-range												
51	6,523,600	5,169,200	-	-	5,169,200	564,400	790,000	-	-	-	-	-	1,354,400
52	2,779,300	-	-	-	-	1,525,400	-	-	-	-	1,253,900	-	2,779,300
53	8,700,900	3,538,700	-	-	3,538,700	3,208,800	381,700	-	-	-	1,571,700	-	5,162,200
54	No Struct.												

TABLE 46 (con.)

Watershed Number	Total Structural Measures	Single Purpose: Flood Prevention	Single Purpose: Recreation	Single Purpose: Municipal & Industrial	Single Purpose: Total	Multiple Purpose: Flood Prevention	Multiple Purpose: Recreation	Multiple Purpose: Recreation & Fish & Wildlife	Multiple Purpose: Water Quality Control	Multiple Purpose: Municipal & Industrial	Multiple Purpose: Drainage	Multiple Purpose: Irrigation	Multiple Purpose: Total
	(Dollars)												
55	2,617,500	-	-	-	-	1,308,750	-	-	-	-	1,308,750	-	2,617,500
56	2,781,500	2,781,500	-	-	2,781,500	-	-	-	-	-	-	-	-
57	2,458,800	-	2,458,800	-	2,458,800	-	-	-	-	-	-	-	-
58	523,100	523,100	-	-	523,100	-	-	-	-	-	-	-	-
59	1,904,200	1,904,200	-	-	1,904,200	-	-	-	-	-	-	-	-
60	No Struct.												
61	No Struct.												
62	2,311,100	2,311,100	-	-	2,311,100	-	-	-	-	-	-	-	-
63	2,754,700	2,754,700	-	-	2,754,700	-	-	-	-	-	-	-	-
64	1,004,000	1,004,000	-	-	1,004,000	-	-	-	-	-	-	-	-
65	PL-566												
66	723,000	-	-	-	-	361,500	-	-	-	-	361,500	-	723,000
67	PL-566												
68	291,000	-	-	-	-	145,500	-	-	-	-	145,500	-	291,000
69	PL-566												
70	5,017,700	4,661,200	-	-	4,661,200	228,060	128,440	-	-	-	-	-	356,500
71	3,384,100	3,384,100	-	-	3,384,100	-	-	-	-	-	-	-	-
72	4,610,750	3,757,750	-	-	3,757,750	528,600	324,400	-	-	-	-	-	853,000
73	7,462,750	6,269,250	-	-	6,269,250	517,550	675,950	-	-	-	-	-	1,193,500
74	3,528,500	3,264,500	-	-	3,264,500	147,900	116,100	-	-	-	-	-	264,000
75	1,450,500	1,241,700	-	-	1,241,700	100,500	108,300	-	-	-	-	-	208,800
76	No Struct.												
77	3,961,100	3,038,800	409,700	-	3,448,500	369,600	143,000	-	-	-	-	-	512,600
78	3,971,650	3,632,950	-	-	3,632,950	236,430	102,270	-	-	-	-	-	338,700
79	854,600	854,600	-	-	854,600	-	-	-	-	-	-	-	-
80	PL-566												
81	186,900	186,900	-	-	186,900	-	-	-	-	-	-	-	-
82	331,800	-	-	-	-	165,900	-	-	-	-	165,900	-	331,800
83	4,723,460	3,813,560	-	-	3,813,560	367,300	542,600	-	-	-	-	-	909,900
84	2,431,510	2,431,510	-	-	2,431,510	-	-	-	-	-	-	-	-
85	293,100	293,100	-	-	293,100	-	-	-	-	-	-	-	-
86	PL-566												
87	PL-566												
88	2,239,600	2,239,600	-	-	2,239,600	-	-	-	-	-	-	-	-
89	874,200	-	-	-	-	437,100	-	-	-	-	437,100	-	874,200
90	1,223,900	-	-	-	-	611,950	-	-	-	-	611,950	-	1,223,900
91	1,061,100	-	-	-	-	530,550	-	-	-	-	530,550	-	1,061,100
92	6,508,860	2,454,300	-	-	2,454,300	2,246,980	-	-	-	107,400	1,540,180	160,000	4,054,560
93	No Struct.												
94	8,389,200	5,978,600	-	-	5,978,600	1,597,550	407,100	-	-	132,200	-	273,750	2,410,600
95	No Struct.												
96	No Struct.												
97	Long-range												
98	No Struct.												
99	No Struct.												
100	7,383,400	5,176,400	-	-	5,176,400	1,635,100	571,900	-	-	-	-	-	2,207,000
101	2,892,300	1,548,300	-	-	1,548,300	1,050,900	204,200	-	-	88,900	-	-	1,344,000
102	1,015,420	660,420	-	-	660,420	177,500	-	-	-	-	177,500	-	355,000
103	3,892,900	542,100	-	-	542,100	1,675,400	-	-	-	-	1,675,400	-	3,350,800
104	4,933,100	2,968,800	-	-	2,968,800	1,051,750	292,400	-	-	-	620,150	-	1,964,300
105	3,120,200	1,544,300	-	-	1,544,300	787,950	-	-	-	-	787,950	-	1,575,900
106	734,500	-	-	-	-	367,250	-	-	-	-	367,250	-	734,500
107	No Struct.												
108	399,700	-	-	-	-	199,850	-	-	-	-	199,850	-	399,700

TABLE 46 (con.)

Watershed Number	Total Structural Measures	Single Purpose: Flood Prevention	Single Purpose: Recreation	Single Purpose: Municipal & Industrial	Single Purpose: Total	Multiple Purpose: Flood Prevention	Multiple Purpose: Recreation	Multiple Purpose: Recreation & Fish & Wildlife	Multiple Purpose: Water Quality Control	Multiple Purpose: Municipal & Industrial	Multiple Purpose: Drainage	Multiple Purpose: Irrigation	Multiple Purpose: Total
	(Dollars)												
1/ 109	5,604,000	2,260,300	-	-	2,260,300	1,671,850	-	-	-	-	1,671,850	-	3,343,700
1/ 110	5,072,300	1,530,800	-	-	1,530,800	1,770,800	-	-	-	-	1,770,700	-	3,541,500
1/ 111	3,065,300	438,800	-	-	438,800	1,313,250	-	-	-	-	1,313,250	-	2,626,500
112	2,543,500	-	-	-	-	1,271,750	-	-	-	-	1,271,750	-	2,543,500
113	2,634,100	-	-	-	-	1,317,050	-	-	-	-	1,317,050	-	2,634,100
114	647,850	-	-	-	-	323,930	-	-	-	-	323,920	-	647,850
115	1,991,000	-	-	-	-	995,500	-	-	-	-	995,500	-	1,991,000
116	PL-566												
117	PL-566												
118	2,422,800	-	-	-	-	1,211,400	-	-	-	-	1,211,400	-	2,422,800
119	4,036,000	-	-	-	-	2,018,000	-	-	-	-	2,018,000	-	4,036,000
120	914,200	-	-	-	-	457,100	-	-	-	-	457,100	-	914,200
121	316,700	-	-	-	-	158,350	-	-	-	-	158,350	-	316,700
122	1,393,010	-	-	-	-	696,500	-	-	-	-	696,510	-	1,393,010
123	748,010	-	-	-	-	374,080	-	-	-	-	373,930	-	748,010
124	2,228,950	-	-	-	-	1,114,480	-	-	-	-	1,114,470	-	2,228,950
125	4,017,700	-	-	-	-	2,008,850	-	-	-	-	2,008,850	-	4,017,700
126	PL-566												
127	2,147,480	-	-	-	-	1,073,740	-	-	-	-	1,073,740	-	2,147,480
128	1,900,750	-	-	-	-	950,370	-	-	-	-	950,380	-	1,900,750
129	Long-range												
130	1,601,300	-	-	-	-	800,650	-	-	-	-	800,650	-	1,601,300
131	PL-566												
132	6,433,000	-	-	-	-	3,216,500	-	-	-	-	3,216,500	-	6,433,000
133	2,209,900	-	-	-	-	1,104,950	-	-	-	-	1,104,950	-	2,209,900
134	C.ofE.Proj.												
A	No Struct.												
B	670,800	-	-	-	-	335,400	-	-	-	-	335,400	-	670,800
TOTAL	226,159,400	122,546,080	6,762,300	372,500	129,680,880	52,171,760	5,089,360	702,900	997,790	1,050,960	35,941,150	524,600	96,478,520

1/Land Treatment - Critical Areas - Federal Costs:

Watershed Number	Total Structural Measures	Flood Prevention	Total
	(Dollars)		
109	115,600	115,600	115,600
110	68,700	68,700	68,700
111	27,000	27,000	27,000
Total	211,300	211,300	211,300

TABLE 47
COST SHARING BY PURPOSES
SOIL CONSERVATION SERVICE UPSTREAM WATERSHED PROJECTS

Water-shed Number	Total Structural Measures	Federal								Non-Federal							
		Flood Prevention	Recreation	Recrea., Fish & Wildlife	Water Quality Control	Munic. & Indus.	Drainage	Irri-gation	Total	Flood Prevention	Recrea-tion	Recres. Fish & W/Life	Water Qual. Contr.	Municipal & In-dustrial	Drainage	Irri-gation	Total
									(Dollars)								
1	6,233,660	5,866,160	-	-	-	-	-	-	5,866,160	309,990	-	-	-	57,510	-	-	367,500
2	No Str.																
3	4,624,600	3,286,450	-	-	909,650	-	-	-	4,196,100	204,860	-	-	88,140	135,500	-	-	428,500
4	2,158,450	1,984,530	-	-	-	-	-	51,910	2,036,440	83,070	-	-	-	-	-	38,940	122,010
5	No Str.																
6	5,563,800	5,116,440	-	-	-	-	-	-	5,116,440	250,310	-	-	-	197,050	-	-	447,360
7	No Str.																
8	3,614,500	3,081,150	-	277,850	-	-	-	-	3,359,000	67,050	-	188,450	-	-	-	-	255,500
9	372,500	-	-	-	-	-	-	-	-	-	-	-	-	372,500	-	-	372,500
10	656,100	644,000	-	-	-	-	-	-	644,000	12,100	-	-	-	-	-	-	12,100
11	1,869,400	1,649,730	-	-	-	-	-	-	1,649,730	169,480	-	-	-	50,190	-	-	219,670
12	Long-range																
13	No Str.																
14	Long-range																
15	4,070,800	3,805,200	-	-	-	-	-	-	3,805,200	265,600	-	-	-	-	-	-	265,600
16	1,816,800	1,698,700	-	-	-	-	-	-	1,698,700	118,100	-	-	-	-	-	-	118,100
17	No Str.																
18	332,600	323,400	-	-	-	-	-	-	323,400	9,200	-	-	-	-	-	-	9,200
19	2,728,800	2,514,200	-	-	-	-	-	-	2,514,200	107,200	-	-	-	107,400	-	-	214,600
20	2,300,900	2,223,200	-	-	-	-	-	-	2,223,200	77,700	-	-	-	-	-	-	77,700
21	No Str.																
22	763,300	-	763,300	-	-	-	-	-	763,300	-	-	-	-	-	-	-	-
23	Long-range																
24	No Str.																
25	No Str.																
26	Long-range																
27	85,900	82,600	-	-	-	-	-	-	82,600	3,300	-	-	-	-	-	-	3,300
28	PL-566																
29	Long-range																
30	No Str.																
31	No Str.																
32	2,697,580	2,574,680	-	-	-	-	-	-	2,574,680	122,900	-	-	-	-	-	-	122,900
33	1,744,350	1,507,040	-	-	-	-	-	-	1,507,040	99,300	-	-	-	138,010	-	-	237,310
34	No Str.																
35	774,500	-	774,500	-	-	-	-	-	774,500	-	-	-	-	-	-	-	-
36	141,700	-	141,700	-	-	-	-	-	141,700	-	-	-	-	-	-	-	-
37	Long-range																
38	Long-range																
39	Long-range																
40	2,745,560	2,639,160	-	-	-	-	-	-	2,639,160	106,400	-	-	-	-	-	-	106,400
41	Long-range																
42	No Str.																
43	No Str.																
44	2,823,950	2,128,720	149,650	114,750	-	-	870	-	2,393,990	119,060	151,350	121,850	-	36,800	900	-	429,960
45	977,200	929,600	-	-	-	-	-	-	929,600	47,600	-	-	-	-	-	-	47,600
46	PL-566																
47	1,518,700	-	1,518,700	-	-	-	-	-	1,518,700	-	-	-	-	-	-	-	-
48	695,600	-	695,600	-	-	-	-	-	695,600	-	-	-	-	-	-	-	-
49	Long-range																
50	Long-range																
51	6,523,600	5,436,400	790,000	-	-	-	-	-	6,226,400	297,200	-	-	-	-	-	-	297,200
52	2,779,300	1,022,700	-	-	-	-	514,800	-	1,537,500	502,700	-	-	-	-	739,100	-	1,241,800
53	8,700,900	5,959,500	381,700	-	-	-	728,350	-	7,069,550	788,000	-	-	-	-	843,350	-	1,631,350
54	No Str.																
55	2,617,500	1,052,100	-	-	-	-	638,800	-	1,690,900	256,650	-	-	-	-	669,950	-	926,600

TABLE 47 (con.)

Water-shed Number	Total Structural Measures	Federal: Flood Prevention	Federal: Recreation	Federal: Recrea., Fish & Wildlife	Federal: Water Quality Control	Federal: Munic. & Indus.	Federal: Drainage	Federal: Irri-gation	Federal: Total	Non-Federal: Flood Prevention	Non-Federal: Recrea-tion	Non-Federal: Recrea. Fish & W/Life	Non-Federal: Water Qual. Contr.	Non-Federal: Municipal & In-dustrial	Non-Federal: Drainage	Non-Federal: Irri-gation	Non-Federal: Total
									-(Dollars)-								
56	2,781,500	2,618,000	-	-	-	-	-	-	2,618,000	163,500	-	-	-	-	-	-	163,500
57	2,458,800	-	2,458,800	-	-	-	-	-	2,458,800	-	-	-	-	-	-	-	-
58	523,100	481,600	-	-	-	-	-	-	481,600	41,500	-	-	-	-	-	-	41,500
59	1,904,200	1,799,000	-	-	-	-	-	-	1.799,000	105,200	-	-	-	-	-	-	105,200
60	No Str.																
61	No Str.																
62	2,311,100	2,186,800	-	-	-	-	-	-	2,186,800	124,300	-	-	-	-	-	-	124,300
63	2,754,700	2,648,800	-	-	-	-	-	-	2,648,800	105,900	-	-	-	-	-	-	105,900
64	1,004,000	956,200	-	-	-	-	-	-	956,200	47,800	-	-	-	-	-	-	47,800
65	PL-566																
66	723,000	298,900	-	-	-	-	181,500	-	480,400	62,600	-	-	-	-	180,000	-	242,600
67	PL-566																
68	291,000	114,100	-	-	-	-	69,300	-	183,400	31,400	-	-	-	-	76,200	-	107,600
69	PL-566																
70	5,017,700	4,536,280	72,120	-	-	-	-	-	4,608,400	352,980	56,320	-	-	-	-	-	409,300
71	3,384,100	3,175,200	-	-	-	-	-	-	3,175,200	208,900	-	-	-	-	-	-	208,900
72	4,610,750	4,085,850	183,400	-	-	-	-	-	4,269,250	200,500	141,000	-	-	-	-	-	341,500
73	7,462,750	6,504,650	334,500	-	-	-	-	-	6,839,150	282,150	341,450	-	-	-	-	-	623,600
74	3,528,500	3,209,300	56,500	-	-	-	-	-	3,265,800	203,100	59,600	-	-	-	-	-	262,700
75	1,450,500	1,288,650	52,950	-	-	-	-	-	1,341,600	53,550	55,350	-	-	-	-	-	108,900
76	No Str.																
77	3,961,100	3,212,800	480,600	-	-	-	-	-	3,693,400	195,600	72,100	-	-	-	-	-	267,700
78	3,971,650	3,685,330	50,650	-	-	-	-	-	3,735,980	184,050	51,620	-	-	-	-	-	235,670
79	854,600	814,800	-	-	-	-	-	-	814,800	39,800	-	-	-	-	-	-	39,800
80	PL-566																
81	186,900	146,100	-	-	-	-	-	-	146,100	40,800	-	-	-	-	-	-	40,800
82	331,800	115,550	-	-	-	-	115,550	-	231,100	50,350	-	-	-	-	50,350	-	100,700
83	4,723,460	3,977,350	269,250	-	-	-	-	-	4,246,600	203,510	273,350	-	-	-	-	-	476,860
84	2,431,510	2,252,600	-	-	-	-	-	-	2,252,600	178,910	-	-	-	-	-	-	178,910
85	293,100	280,000	-	-	-	-	-	-	280,000	13,100	-	-	-	-	-	-	13,100
86	PL-566																
87	PL-566																
88	2,239,600	1,371,150	-	-	-	-	-	-	1,371,150	868,450	-	-	-	-	-	-	868,450
89	874,200	327,700	-	-	-	-	199,000	-	526,700	109,400	-	-	-	-	238,100	-	347,500
90	1,223,900	458,250	-	-	-	-	278,150	-	736,400	153,700	-	-	-	-	333,800	-	487,500
91	1,061,100	421,100	-	-	-	-	255,700	-	676,800	109,450	-	-	-	-	274,850	-	384,300
92	6,508,860	4,334,900	-	-	-	-	808,430	71,900	5,215,230	366,380	-	-	-	107,400	731,750	88,100	1,293,630
93	No Str.																
1/94	8,389,200	7,341,600	226,650	-	-	59,900	-	131,930	7,760,080	234,550	180,450	-	-	72,300	-	141,820	629,120
95	No Str.																
96	No Str.																
97	Long-range																
98	No Str.																
99	No Str.																
100	7,383,400	6,677,650	300,450	-	-	-	-	-	6,978,100	133,850	271,450	-	-	-	-	-	405,300
101	2,892,300	2,509,350	101,250	-	-	-	-	-	2,610,600	89,850	102,950	-	-	88,900	-	-	281,700
102	1,015,420	724,420	-	-	-	-	94,900	-	819,320	113,500	-	-	-	-	82,600	-	196,100
103	3,892,900	1,539,450	-	-	-	-	1,036,850	-	2,576,300	678,050	-	-	-	-	638,550	-	1,316,600
104	4,933,100	3,630,750	144,350	-	-	-	362,000	-	4,137,100	389,800	148,050	-	-	-	258,150	-	796,000
105	3,120,200	1,978,050	-	-	-	-	459,050	-	2,437,100	354,200	-	-	-	-	328,900	-	683,100
106	734,500	278,150	-	-	-	-	168,850	-	447,000	89,100	-	-	-	-	198,400	-	287,500
107	No Str.																
108	399,700	141,850	-	-	-	-	86,150	-	228,000	58,000	-	-	-	-	113,700	-	171,700

TABLE 47 (con.)

Water-shed Number	Total Structural Measures	Federal: Flood Prevention	Federal: Recreation	Federal: Recrea., Fish & Wildlife	Federal: Water Quality Control	Federal: Munic. & Indus.	Federal: Drainage	Federal: Irri-gation	Federal: Total	Non-Federal: Flood Prevention	Non-Federal: Recrea-tion	Non-Federal: Recrea. Fish & W/Life	Non-Federal: Water Qual. Contr.	Non-Federal: Municipal & In-dustrial	Non-Federal: Drainage	Non-Federal: Irri-gation	Non-Federal: Total
	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	-(Dollars)-	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
2/109	5,604,000	3,314,800	-	-	-	-	856,200	-	4,171,000	617,350	-	-	-	-	815,650	-	1,433,000
2/110	5,072,300	2,765,150	-	-	-	-	908,850	-	3,674,000	536,450	-	-	-	-	861,850	-	1,398,300
2/111	3,065,300	1,494,800	-	-	-	-	675,400	-	2,170,200	257,250	-	-	-	-	637,850	-	895,100
112	2,543,500	1,058,050	-	-	-	-	642,350	-	1,700,400	213,700	-	-	-	-	629,400	-	843,100
113	2,634,100	1,084,150	-	-	-	-	658,150	-	1,742,300	232,900	-	-	-	-	658,900	-	891,800
114	647,850	275,580	-	-	-	-	167,320	-	442,900	48,350	-	-	-	-	156,600	-	204,950
115	1,991,000	800,000	-	-	-	-	485,700	-	1,285,700	195,500	-	-	-	-	509,800	-	705,300
116	PL-566																
117	PL-566																
118	2,422,800	956,650	-	-	-	-	580,550	-	1,537,200	254,750	-	-	-	-	630,850	-	885,600
119	4,036,000	1,609,050	-	-	-	-	977,150	-	2,586,200	408,950	-	-	-	-	1,040,850	-	1,449,800
120	914,200	383,050	-	-	-	-	232,550	-	615,600	74,050	-	-	-	-	224,550	-	298,600
121	316,700	123,850	-	-	-	-	75,150	-	199,000	34,500	-	-	-	-	83,200	-	117,700
122	1,393,010	572,240	-	-	-	-	347,780	-	920,020	124,270	-	-	-	-	348,720	-	472,990
123	748,010	315,950	-	-	-	-	191,760	-	507,710	58,120	-	-	-	-	182,180	-	240,300
124	2,228,950	911,280	-	-	-	-	548,870	-	1,460,150	203,200	-	-	-	-	565,600	-	768,800
125	4,017,700	1,694,350	-	-	-	-	1,028,750	-	2,723,100	314,500	-	-	-	-	980,100	-	1,294,600
126	PL-566																
127	2,147,480	903,290	-	-	-	-	549,640	-	1,452,930	170,450	-	-	-	-	524,100	-	694,550
128	1,900,750	780,200	-	-	-	-	473,700	-	1,253,900	170,180	-	-	-	-	476,670	-	646,850
129	Long-range																
130	1,601,300	644,750	-	-	-	-	391,550	-	1,036,300	155,900	-	-	-	-	409,100	-	565,000
131	PL-566																
132	6,433,000	2,646,450	-	-	-	-	1,606,850	-	4,253,300	570,050	-	-	-	-	1,609,650	-	2,179,700
133	2,209,900	706,900	-	-	-	-	706,900	-	1,413,800	398,050	-	-	-	-	398,050	-	796,100
134	C. of E. Proj.																
A	No Struct.																
B	670,800	249,150	-	-	-	-	151,250	-	400,400	86,250	-	-	-	-	184,150	-	270,400
TOTAL -	226,159,400	158,937,580	9,946,620	392,600	909,650	59,900	18,254,670	255,740	188,756,760	15,780,270	1,905,040	310,300	88,140	1,363,560	17,686,470	268,860	37,402,640

1/Hardship Area.
2/Land Treatment - Critical Areas - Federal Costs:

W/S No.	Total Struc-Measures	Flood Prevention	Total
109	$ 115,600	$ 115,600	$115,600
110	68,700	68,700	68,700
111	27,000	27,000	27,000
Total	211,300	211,300	211,300

TABLE 48
PROJECT BENEFITS AND COSTS
SOIL CONSERVATION SERVICE UPSTREAM WATERSHED PROJECTS

Watershed No.	Program	Benefited Area (Acres)	Urban	Damage Reduction	Crop Damage Reduced by Drainage	Damage Reduction Subtotal	More Intensive and/or Changed Land Use	Incidental Recreation	Indirect Benefits	Municipal & Industrial Water	Recreation	Recreation & Fish & Wildlife	Irrigation	Water Quality Control	Redevelopment	Secondary	C of E Downstream Benefits	Total Benefits	Total Annual Cost	Benefit-Cost Ratio
			(Thousand Dollars)																	
1	30 FWR, 1 FWR&M-I	7,090	-	113.9	-	113.9	80.6	20.3	-	4.0	-	-	-	-	10.2	35.0	-	264.0	208.1	1.3:1
2	No Structures																			
3	11 FWR, 2 FWR&M-I	2,762	-	39.9	-	39.9	51.7	13.8	-	7.1	-	-	-	-	-	13.9	-	126.4	121.4	1.0:1
	and 1 FWR&WQ													40.3		4.0		44.3	33.5	1.3:1
4	13 FWR	3,760	-	53.4	-	53.4	25.0	11.8	5.3	-	-	-	-	-	3.7	11.0	-	110.2	69.7	1.6:1
	and 1 FWR&I	(1,000)											24.1			2.4		26.5	3.4	7.9:1
5	No Structures																			
6	21 FWR, 1 FWR&M-I	4,330	-	73.9	-	73.9	80.2	20.9	7.4	14.5	-	-	-	-	9.0	22.3	-	228.2	185.1	1.2:1
7	No Structures																			
8	13 FWR,1 FWR&F.W.	3,627	-	55.8	-	55.8	33.5	5.2	5.6	-	-	51.0	-	-	6.2	17.1	-	174.4	121.9	1.4:1
9	1 M-I	-	-	-	-	-	-	1.2	-	15.3	-	-	-	-	.7	1.6	-	18.8	13.2	1.4:1
10	5 FWR	1,111	-	12.9	-	12.9	9.7	1.3	1.3	-	-	-	-	-	1.3	3.1	-	29.6	22.4	1.3:1
11	5 FWR, 1 FWR&M-I	3,731	-	42.7	-	42.7	30.6	3.2	4.3	1.8	-	-	-	-	2.8	10.1	-	95.5	62.4	1.5:1
12	Long-range																			
13	No Structures																			
14	Long-range																			
15	31 FWR	6,430	54.8	45.3	-	100.1	29.6	7.7	4.5	-	-	-	-	-	14.6	16.0	-	172.5	139.1	1.2:1
16	8 FWR	5,350	3.4	36.0	-	39.4	21.8	4.8	3.9	-	-	-	-	-	3.2	7.5	-	80.6	61.1	1.3:1
17	No Structures																			
18	2 FWR	658	-	6.8	-	6.8	6.9	1.1	.7	-	-	-	-	-	.6	1.8	-	17.9	11.3	1.6:1
19	8 FWR, 1 FWR&M-I	2,835	-	26.5	-	26.5	34.0	6.8	2.6	9.7	-	-	-	-	4.6	10.7	-	94.9	91.8	1.0:1
20	10 FWR	2,163	-	23.8	-	23.8	32.7	5.3	2.4	-	-	-	-	-	3.9	8.2	-	76.3	77.4	1.0:1
21	No Structures																			
22	1 R(Forest Serv.)																			
23	Long-range																			
24	No Structures																			
25	No Structures																			
26	Long-range																			
27	1 FWR	320	-	1.6	-	1.6	2.9	.3	.2	-	-	-	-	-	.2	.6	-	5.8	3.0	1.9:1
28	PL-566																			
29	Long-range																			
30	No Structures																			
31	No Structures																			
32	12 FWR	3,050	-	40.5	-	40.5	29.0	5.3	4.0	-	-	-	-	-	10.4	6.9	-	96.1	90.8	1.1:1
33	6 FWR, 1 FWR&M-I	2,660	-	41.0	-	41.0	30.2	4.0	4.1	10.0	-	-	-	-	2.9	10.4	-	102.6	58.9	1.7:1
34	No Structures																			
35	1 R(Forest Serv.)																			
36	1 R(Forest Serv.)																			
37	Long-range																			
38	Long-range																			
39	Long-range																			
40	22 FWR	5,000	-	63.6	-	63.6	38.6	6.8	6.4	-	-	-	-	-	4.9	13.9	-	134.2	94.4	1.4:1
41	Long-range																			
42	No Structures																			
43	No Structures																			
44	15 FWR, 1 FWR&M-I																			
	*2 FWR&R, 7 Mi.CI	5,300	-	23.0	4.3	27.3	52.2	7.2	-	2.5	36.0	56.8	-	-	5.2	18.0	38.6	243.8	99.6	2.4:1
45	10 FWR	2,610	-	29.3	-	29.3	18.4	2.8	-	-	-	-	-	-	1.8	6.4	9.2	67.9	33.8	2.0:1
46	PL-566																			
47	2 R(Forest Serv.)																			
48	1 R(Forest Serv.)																			

TABLE 48 (CONT'D)

Watershed No.	Program	Benefited Area (Acres)	Urban	Damage Reduction	Crop Damage Reduced by Drainage	Damage Reduction Subtotal	More Intensive and/or Changed Land Use	Incidental Recreation	Indirect Benefits	Municipal & Industrial Water	Recreation	Recreation & Fish & Wildlife	Irrigation	Water Quality Control	Redevelopment	Secondary	C of E Downstream Benefits	Total Benefits	Total Annual Cost	Benefit-Cost Ratio
			(Thousand Dollars)																	
49	Long-range																			
50	Long-range																			
51	47 FWR, 1 FWR&R	11,480	-	57.2	-	57.2	61.7	16.2	5.7	-	86.1	-	-	-	11.3	23.4	923.0	1,184.6	223.3	5.3:1
52	161 Mi. CI	61,580	-	-	295.2	295.2	-	-	29.5	-	-	-	-	-	6.2	29.6	-	360.5	78.4	4.6:1
53	31 FWR, 2 FWR&R, & 190 Mi. CI	92,300	-	96.4	238.9	335.3	65.1	17.2	33.5	-	14.6	-	-	-	16.3	41.7	247.6	771.3	280.2	2.8:1
54	No Structures																			
55	165 Mi. CI	47,808	5.0	-	301.7	306.7	-	-	30.7	-	-	-	-	-	5.9	30.6	-	373.9	79.8	4.7:1
56	7 FWR	2,975	9.5	71.9	-	81.4	33.9	10.7	7.2	-	-	-	-	-	7.0	13.9	248.4	402.5	111.1	3.6:1
57	3 R(Forest Serv.)																			
58	5 FWR	1,055	-	16.1	-	16.1	8.6	2.7	1.6	-	-	-	-	-	.9	3.3	21.2	54.4	18.2	3.0:1
59	9 FWR	2,420	-	47.6	-	47.6	19.0	4.8	4.8	-	-	-	-	-	3.2	8.0	89.0	176.4	64.2	2.7:1
60	No Structures																			
61	No Structures																			
62	25 FWR	4,640	-	52.2	-	52.2	30.4	7.9	5.2	-	-	-	-	-	4.1	11.3	93.1	204.2	79.6	2.6:1
63	10 FWR	6,165	-	51.0	-	51.0	32.9	7.6	5.1	-	-	-	-	-	4.7	11.7	151.0	264.0	92.8	2.8:1
64	8 FWR	7,915	-	24.6	-	24.6	17.5	3.4	2.5	-	-	-	-	-	1.7	5.4	41.0	96.1	34.6	2.8:1
65	PL-566																			
66	38 Mi. CI	16,000	-	-	107.2	107.2	-	-	10.7	-	-	-	-	-	.8	10.7	-	129.4	22.3	5.8:1
67	PL-566																			
68	41 Mi. CI	8,640	-	-	16.5	16.5	-	-	1.6	-	-	-	-	-	.3	1.7	-	20.1	8.8	2.3:1
69	PL-566																			
70	36 FWR, 1 FWR&R	4,610	24.8	100.6	-	125.4	57.0	17.4	12.1	-	12.9	-	-	-	8.6	25.7	197.9	457.0	172.2	2.7:1
71	23 FWR	4,560	2.1	59.4	-	61.5	32.7	13.2	6.0	-	-	-	-	-	5.8	13.3	62.4	194.9	115.4	1.7:1
72	25 FWR, 1 FWR&R	5,355	2.9	85.6	-	88.5	35.4	12.8	8.8	-	79.6	-	-	-	7.7	23.7	7.8	264.3	157.4	1.7:1
73	35 FWR, 2 FWR&R	11,900	1.5	88.4	-	89.9	59.6	23.0	9.0	-	43.2	-	-	-	12.8	26.1	205.9	469.5	253.4	1.9:1
74	32 FWR, 1 FWR&R	8,256	-	100.5	-	100.5	55.8	12.4	10.0	-	14.0	-	-	-	7.9	23.0	100.6	324.2	121.8	2.6:1
75	15 FWR, 1 FWR&R	3,392	-	51.9	-	51.9	30.7	5.4	5.2	-	11.2	-	-	-	2.8	13.4	46.5	167.1	50.7	3.4:1
76	No Structures																			
77	22 FWR, 1 FWR&R(FS Rec.not included)	6,335	4.2	75.5	-	79.7	38.5	6.7	7.6	-	16.3	-	-	-	6.1	17.0	91.1	263.0	120.9	2.2:1
78	25 FWR, 1 FWR&R	9,720	-	57.9	-	57.9	23.0	11.2	5.8	-	26.5	-	-	-	6.8	13.6	108.2	253.0	135.2	1.8:1
79	6 FWR	3,290	-	8.5	-	8.5	4.3	2.3	.8	-	-	-	-	-	1.5	1.9	19.3	38.6	29.2	1.3:1
80	PL-566																			
81	1 FWR	1,800	-	12.9	-	12.9	-	3.8	1.3	-	-	-	-	-	.3	1.7	-	20.0	6.3	3.1:1
82	25 Mi. CI	9,754	-	-	38.1	38.1	-	-	-	-	-	-	-	-	.6	3.7	-	42.4	10.4	4.1:1
83	28 FWR, 1 FWR&R	6,240	-	78.0	-	78.0	51.1	14.4	7.8	-	48.6	-	-	-	8.2	23.1	-	231.2	161.2	1.4:1
84	20 FWR	3,220	-	43.0	-	43.0	26.4	9.6	4.3	-	-	-	-	-	4.2	9.9	-	97.4	83.3	1.2:1
85	1 FWR	65	-	2.2	-	2.2	.7	.8	.2	-	-	-	-	-	.5	.4	17.8	22.6	9.6	2.3:1
86	PL-566																			
87	PL-566																			
88	121 Mi. CI	83,366	-	-	441.4	441.4	-	-	-	-	-	-	-	-	3.2	44.1	-	488.7	66.6	7.3:1
89	43 Mi. CI	21,190	-	-	120.5	120.5	-	-	-	-	-	-	-	-	1.2	12.1	-	133.8	25.8	5.2:1
90	74 Mi. CI	50,880	-	-	232.1	232.1	-	-	-	-	-	-	-	-	1.7	23.2	-	257.0	36.1	7.1:1
91	73 Mi. CI	62,400	-	-	300.8	300.8	-	-	-	-	-	-	-	-	3.4	30.2	-	334.4	32.2	10.4:1
92	15 FWR, 1 FWR&M-I,	49,980	-	148.2	106.8	255.0	19.6	21.1	25.5	12.0	-	-	-	-	12.2	30.8	11.2	387.4	199.8	1.9:1
	2 FWR&I, 68 Mi.CI	(I-1,310)											18.6		.4	1.8		20.8	5.5	3.8:1
93	No Structures																			
94	22 FWR, 1 FWR&M-I,	6,820	-	84.5	-	84.5	71.3	15.7	8.5	7.8	29.0	-	-	-	13.1	26.4	-	256.3	272.2	0.9:1
	1 FWR&R, 2 FWR&I	(I- 756)											18.2		.4	1.9		20.5	9.6	2.1:1
95	No Structures																			
96	No Structures																			
97	Long-range																			
98	No Structures																			
99	No Structures																			

TABLE 48 (CONT'D)

Water-shed No.	Program	Benefited Area (Acres)	Urban	Damage Reduction	Crop Damage Reduced by Drainage	Damage Reduction Subtotal	More Intensive and/or Changed Land Use	Incidental Recreation	Indirect Benefits	Municipal & Industrial Water	Recreation	Recreation & Fish & Wildlife	Irrigation	Water Quality Control	Redevelopment	Secondary	C of E Downstream Benefits	Total Benefits	Total Annual Cost	Benefit-Cost Ratio
							- - - - - - - - - - - - - (Thousand Dollars) - - - - - - - - - - - - -													
100	14 FWR, 1 FWR&R	11,305	-	55.9	-	55.9	47.9	9.2	5.6	-	60.0	-	-	-	12.2	21.0	-	211.8	245.0	0.9:1
101	12 FWR, 1 FWR&M-I, 1 FWR&R	7,576	-	96.1	-	96.1	62.9	4.4	9.6	4.0	39.6	-	-	-	5.1	25.5	-	247.2	99.2	2.5:1
102	2 FWR, 16 Mi. CI	16,495	-	45.5	55.2	100.7	-	1.4	10.0	-	-	-	-	-	1.3	10.1	-	123.5	36.5	3.4:1
103	4 FWR, 90 Mi. CI	18,335	-	42.7	28.1	70.8	234.6	3.2	7.1	-	-	-	-	-	-	53.8	-	369.5	248.2	1.5:1
104	17 FWR, 1 FWR&R, 46 Mi. CI	7,175	-	72.0	7.2	79.2	117.8	8.5	7.9	-	19.3	-	-	-	9.1	23.2	-	265.0	216.6	1.2:1
105	7 FWR, 55 Mi. CI	10,515	-	63.0	13.5	76.5	106.7	3.0	7.7	-	-	-	-	-	5.8	20.0	-	219.7	168.0	1.3:1
106	36 Mi. CI	2,580	-	-	12.9	12.9	25.2	-	1.3	-	-	-	-	-	-	2.5	-	41.9	31.7	1.3:1
107	No Structures																			
108	15 Mi. CI	7,000	-	-	34.0	34.0	-	-	3.4	-	-	-	-	-	-	3.4	-	40.8	11.5	3.5:1
109	44 FWR, 179 Mi. CI	92,941	-	89.4	294.3	383.7	53.2	26.2	8.9	-	-	-	-	-	5.0	20.9	-	497.9	256.1	1.9:1
110	33 FWR, 183 Mi. CI	53,148	-	41.3	240.1	281.4	23.5	18.8	4.1	-	-	-	-	-	2.5	10.2	-	340.5	206.8	1.6:1
111	9 FWR, 140 Mi. CI	56,034	-	21.2	413.5	434.7	13.8	5.2	2.1	-	-	-	-	-	.6	4.9	-	461.3	147.4	3.1:1
112	152 Mi. CI	57,458	-	-	466.7	466.7	-	-	-	-	-	-	-	-	2.9	46.6	-	516.2	125.9	4.1:1
113	166 Mi. CI	42,617	-	-	314.3	314.3	-	-	-	-	-	-	-	-	3.0	31.4	-	348.7	116.1	3.0:1
114	32 Mi. CI	6,713	-	-	50.7	50.7	-	-	-	-	-	-	-	-	.8	5.0	-	56.5	25.8	2.2:1
115	138 Mi. CI	52,322	-	-	258.1	258.1	-	-	-	-	-	-	-	-	2.2	25.7	-	286.0	103.1	2.8:1
116	PL-566																			
117	PL-566																			
118	116 Mi. CI	86,694	-	-	722.3	722.3	-	-	-	-	-	-	-	-	2.6	72.3	-	797.2	144.3	5.5:1
119	189 Mi. CI	69,047	-	-	501.6	501.6	-	-	-	-	-	-	-	-	4.4	50.2	-	556.2	179.1	3.1:1
120	40 Mi. CI	9,615	-	-	71.2	71.2	-	-	-	-	-	-	-	-	1.0	7.2	-	79.4	36.3	2.2:1
121	18 Mi. CI	3,809	-	-	23.4	23.4	-	-	-	-	-	-	-	-	.2	2.3	-	25.9	12.7	2.0:1
122	54 Mi. CI	16,544	-	-	107.4	107.4	-	-	-	-	-	-	-	-	-	10.7	-	118.1	42.8	2.8:1
123	35 Mi. CI	12,695	-	-	91.9	91.9	-	-	-	-	-	-	-	-	-	9.2	-	101.1	23.3	4.3:1
124	110 Mi. CI	72,373	-	-	406.1	406.1	-	-	-	-	-	-	-	-	-	40.6	-	446.7	159.1	2.8:1
125	211 Mi. CI	112,569	-	-	762.2	762.2	-	-	-	-	-	-	-	-	4.4	76.1	-	842.7	228.1	3.7:1
126	PL-566																			
127	133 Mi. CI	116,879	-	-	262.8	262.8	-	-	-	-	-	-	-	-	3.4	26.3	-	292.5	87.9	3.3:1
128	124 Mi. CI	49,710	-	-	305.8	305.8	-	-	-	-	-	-	-	-	-	30.7	-	336.5	95.6	3.5:1
129	Long-range																			
130	49 Mi. CI	43,660	-	-	202.3	202.3	-	-	20.2	-	-	-	-	-	-	20.3	-	242.8	48.7	5.0:1
131	PL-566																			
132	106 Mi. CI	65,540	-	-	502.3	502.3	562.0	-	50.2	-	-	-	-	-	-	106.4	-	1,220.9	197.7	6.2:1
133	55 Mi. CI	52,480	-	-	365.2	365.2	30.9	-	36.5	-	-	-	-	-	-	36.7	-	469.3	66.9	7.0:1
134	Corps of Eng. Proj.																			
A	No Structures																			
B	23 Mi. CI	13,500	-	-	22.8	22.8	-	-	2.3	-	-	-	-	-	-	2.3	-	27.4	25.9	1.1:1
PROJECT TOTALS																				
Flood Prevention		1,846,227	108.2	2,671.1	8,739.4	11,518.7	2,661.3	448.8	480.6	73.4	536.9	107.8	-	-	323.0	1,563.0	2,730.8	20,444.3	8,091.3	2.5:1
Multipurp. Water Quality		-	-	-	-	-	-	-	-	-	-	-	-	40.3	-	4.0	-	44.3	33.5	1.3:1
Multipurpose Irrigation		(3,066)	-	-	-	-	-	-	-	-	-	-	60.9	-	.8	6.1	-	67.8	18.5	3.7:1
Single Purpose Municipal		-	-	-	-	-	-	1.2	-	15.3	-	-	-	-	.7	1.6	-	18.8	13.2	1.4:1
Drainage (Table 44)		(1,531,848)	-	-	-	-	1/8,739.4	-	-	-	-	-	-	-	66.6	537.5	-	9,343.5	2,839.9	3.3:1
Recreation-Forest Service (Table 45)		-	-	-	-	-	-	-	-	-	2/226.3	-	-	-	-	-	-	226.3	226.3	1.0:1
BASIN TOTALS		1,846,227	108.2	2,671.1	8,739.4	11,518.7	11,400.7	450.0	480.6	88.7	763.2	107.8	60.9	40.3	391.1	2,112.2	2,730.8	30,145.0	11,222.7	2.7:1

LEGEND: FWR - Floodwater Retarding, R - Recreation, M-I - Municipal & Industrial Water Supply, WQ - Water Quality Control, I - Irrigation, CI - Channel Improvement, F.W. - Fish & Wildlife.

1/Drainage benefits from Table 44 .

2/Recreation benefits: Forest Service single purpose structures from Table 45. Benefits were assumed to equal the costs.

* Includes 1 FWR&R and 1 FWR&F.W.

for irrigation; 6,885 acre-feet for water quality control; 53,723 acre-feet for recreation; 5,577 acre-feet for fish and wildlife; and 4,237 acre-feet for surcharge storage in the 10 single-purpose recreation structures and 1 single-purpose municipal and industrial structure.

(3) Structure stage capacity developed to full site potential indicated that 607 structures in 53 subwatershed in the 10-15-year plan have a total of 2,404,475 acre-feet of storage capacity in excess of the above indicated quantities, but not exceeding 25,000 acre-feet total capacity in any one structure. Table 39 lists potential remaining storage capacity for other purposes by subwatersheds and tables on Plates 21 to 46 list remaining storage by individual structure site numbers. This remaining storage potential is available for recreation, fish and wildlife, irrigation, water quality control, water supply, and other unforeseen beneficial needs that may develop in the future.

(4) Total surface areas of 824 potential structures included in the 10- to 15-year plan for the single-purpose floodwater retarding, recreation, and municipal and industrial are as follows: 15,287 acres for sediment accumulation over a 50-year period; 79,051 acres for floodwater detention; 880 acres for recreation and 1,057 acres for surcharge storage; and 40 acres for municipal and industrial storage.

(5) Total surface areas of 36 multiple-purpose floodwater detention and recreation, fish and wildlife, municipal and industrial, water quality control, and irrigation, by purposes are as follows: 2,829 acres for recreation; 640 acres for fish and wildlife; 946 acres for municipal and industrial; 245 acres for water quality control; 634 acres for irrigation; and 9,776 acres for floodwater detention associated with the five above purposes. Provisions for sediment storage are included in the listed special purpose permanent pool areas.

(6) Table 39 lists, by subwatersheds, all structure pertinent data.

33. LONG-RANGE PLAN - POTENTIAL STRUCTURAL MEASURES

a. Subwatershed-type projects listed in the long-range plan include 294 floodwater retarding or other impoundment-type structures in the following 14 subwatersheds: Nos. 12, 14, 23, 26, 29, 35, 36, 37, 38, 39, 41, 49, 50, and 97. Other long-range structural measures include 34 miles of channel improvement in Subwatershed No. 129. One long-range subwatershed-type irrigation project located in Subwatershed No. 130 consists of a pumping station for water diversion from the White River and an associated distribution system of 13 miles of canals with appurtenant structures. This subwatershed is included in the 10- to 15-year plan due to other planned measures. Table 49 lists all potential

upstream structural measures included in the long-range plan. Watershed protection measures are planned for installation in these 15 subwatersheds within the next 10 to 15 years.

TABLE 49

SUMMARY OF ALL UPSTREAM STRUCTURAL MEASURES IN THE LONG-RANGE PLAN

Purpose	Sub-watersheds (No.)	Structures (No.)	Total storage (ac.-ft.)	Channel Improvement (miles)	Irrigation canals (miles)
IMPOUNDMENT TYPE STRUCTURES					
Single-purpose:					
Flood Prevention	14	280	395,692	-	-
Recreation	2	5	10,643	-	-
Multiple-purpose:					
Flood prevention & recreation	6	6	11,190	-	-
Flood prevention & municipal & industrial	2	3	3,571	-	-
Flood prevention & agricultural water management channel improvement	1	-	-	34	-
Irrigation canals (with pumping station - Watershed No.130)	1	-	-	-	13
Total	(1)	294	421,096	34	13

(1) Total of 15 subwatersheds in long-range plan. Direct addition not possible due to overlapping purposes.

b. More detailed data regarding these subwatersheds are available in this and other appendixes of the report.

34. EXISTING, UNDER CONSTRUCTION, AUTHORIZED, AND PROPOSED PROJECTS IN PRIOR REPORTS

a. The coordinated comprehensive plan for the White River Basin includes those land and water resource projects and programs that would contribute to meeting the needs projected to the year 2020.

b. The existing, under construction, certain authorized and proposed projects included in previous reports are a necessary part of the plan to help meet these needs. Projects in these categories are discussed in Section II and existing and authorized are listed in Tables 2 through 5 of this Appendix. The Lone Rock and Water Valley Dam and Reservoir projects on the Buffalo and Eleven Point Rivers, respectively, are the only authorized projects not included in the plan. The other authorized projects and those projects presented in prior reports are considered to be in the 10- to 15-year category of the comprehensive plan.

35. ADDITIONAL PROJECTS AND PROGRAMS IN THE 10- TO 15-YEAR PLAN

a. Additional projects or programs which should be constructed or implemented in the next 10 to 15 years include:

(1) County Line Dam and Reservoir for flood control, municipal and industrial water supply, water quality control, recreation, and fish and wildlife enhancement.

(2) Wolf Bayou Dam and Reservoir for flood control, hydroelectric power, recreation, and fish and wildlife enhancement.

(3) Myatt Creek, Wild Horse, and Bell Foley Dams and Reservoirs for flood control, recreation, and fish and wildlife enhancement.

(4) Quarry Dam and Reservoir for reregulation of flows from the existing Greers Ferry project for recreation and fish and wildlife enhancement.

(5) Installation of two additional hydroelectric power generating units with a total capacity of 85,000 kilowatts at the existing Norfork project.

(6) Land treatment measures on a total of 8,897,570 acres of which 3,388,000 are cropland, 4,051,700 are grassland, 928,800 are forest land, 18,090 are for recreational purposes, and 510,980 are wildlife habitat.

(7) Fifty upstream watershed projects containing 849 floodwater retarding structures. In 10 of these watersheds there would be 968 miles of multiple-purpose flood prevention and agricultural water management channels and 6 miles of single-purpose flood control channels. Of the 849 floodwater retarding structures in the plan, 813 would be single-purpose floodwater retarding structures. In addition to the floodwater retarding feature, 17 structures include recreation and 2 include fish and wildlife; 11 include municipal and industrial water supply; 5 include irrigation supply; and 1 includes storage for water quality control.

(8) Twenty-nine additional watersheds containing 2,543 miles of multiple-purpose flood prevention and agricultural water management channels.

(9) One additional watershed containing a single-purpose municipal and industrial water-supply structure.

(10) Twelve levee and channel improvement projects for local flood protection along the Black and White Rivers and their tributaries in the Coastal Plain area. The total length of these levees would be about 313 miles.

(11) One major drainage outlet on Bayou Des Arc. This channel improvement would be about 13 miles in length.

(12) A pumped-storage hydroelectric power installation which would have an installed capacity of about 500,000 kilowatts. Additional studies outside the scope of this investigation will be required to determine location and definite economic justification of the project.

(13) Navigation improvement on the White River from its mouth to Newport, Arkansas. The preliminary studies relating to navigation were curtailed as soon as the results indicated that future possibilities for navigation by a series of locks and dams were favorable. It was then concluded that other elements of the plan should be planned to be compatible with navigation on the lower White River by locks and dams. A separate study has been authorized to verify the economic justification of the project including the possibility of extentions upstream from Newport to Batesville, Arkansas, and on the Little Red River from its mouth to near Searcy, Arkansas.

(14) Increased land holdings of 373,000 acres in the Mark Twain, Clark, and Ozark-St. Francis National Forests to provide protection to special scenic, geological, and botanical interest areas, and for the stream preservation program.

(15) Ten single-purpose recreation reservoirs all on National Forest lands in 7 upstream watersheds with a combined surface area of 880 acres.

(16) Eight scenic drives all in the National Forests, with the exception of Arkansas State Highway 7 south of Harrison, Arkansas, to the basin boundary.

(17) Expansion of the Ozark National Scenic Riverways by inclusion of the lower 20 miles of the Current River within the Mark Twain National Forest in Missouri.

(18) A national recreation area for the Beaver, Table Rock, Bull Shoals, and Norfork Reservoir complex.

(19) Preservation of segments of 9 streams in Missouri and 10 in Arkansas. Preservation would be accomplished by acquisition of minimum acreage of adjacent lands in fee or scenic easements. Fee acquisition would be primarily at access points. Certain segments of the streams would be developed for intensive use while others would be left alone to exemplify a primitive environment.

(20) Acquisition by the Federal Government of 4,000 acres adjacent to the White River National Wildlife Refuge. The area would be used chiefly to provide winter feeding habitat for Canada geese.

(21) Acquisition by the State of Arkansas of 24,000 acres of bottom-land hardwood areas in the lower reaches of the White River Basin. These areas are needed to reserve some of the highly productive wildlife habitat being rapidly lost to farm production.

(22) The expansion of the Montauk State Fish Hatchery in Missouri to increase production from 96,000 to 150,000 pounds of trout per year.

(23) Nine lakes in the States of Arkansas and Missouri which would have a combined surface area of about 3,000 acres and would be used primarily for fishing.

(24) Stream access sites for the streams included as national scenic rivers, stream preservation, and numerous other streams. More than 100 sites are included in the 10- to 15-year plan. Some sites would be developed for intensive use while others would provide for only limited use in order to preserve natural environmental conditions.

(25) Three hiking and saddle trails in the Mark Twain National Forest.

(26) Ozark Scenic Railway from the southern basin boundary near Cabot, Arkansas, to Newport, thence generally along the White River to Branson, Missouri, and thence northward to Springfield, Missouri. This existing railroad would, by provision of scheduled

passenger trains especially during the summer months, offer a means by which people who for various reasons prefer this mode of transportation, could visit and enjoy the picturesque beauty of the basin.

(27) Tourist information centers. There are many varied recreational centers available, and the public should be informed of them.

(28) Preservation of significant and important areas of archaeological, historical, and natural science value.

(29) Established water quality control standards should be implemented and maintained for protection of fish and wildlife resources and other purposes.

(30) Private water development projects including 5,400 and 1,300 acres of farm ponds in Arkansas and Missouri, respectively; 1,380 acres of municipal and industrial water supply lakes; fee-fishing lakes; and access and other commercial facilities.

36. PROJECTS AND PROGRAMS IN THE LONG-RANGE PLAN

a. Projects and programs in the long-range plan were studied in sufficient detail to determine only their general applicability in meeting foreseeable needs and their compatibility with other projects and programs in the area. The long-range plan includes the following.

(1) Flood prevention projects which include 280 single-purpose floodwater retarding structures, 3 floodwater retarding and municipal and industrial water supply structures, 6 floodwater retarding and recreation structures. Of these projects, 36 floodwater retarding structures and 1 floodwater retarding and recreation structure are alternatives for major tributary reservoirs which are in the 10- to 15-year plan.

(2) Five upstream reservoirs on Forest Service lands for recreation.

(3) Eleven main stem and major tributary reservoirs. Five of these reservoirs are alternatives for other projects or programs included in the 10- to 15-year plan.

(4) The addition of 24,000 kilowatts of hydroelectric capacity to the privately owned Ozark Beach project located downstream from Table Rock Dam on the White River near Forsyth, Missouri.

(5) A pumped-storage hydroelectric power development of about 600,000 kilowatts at the Millers Point site on the Greers Ferry Reservoir.

(6) Three levees with a total length of about 28 miles.

(7) A channel improvement project on Flat Creek to operate in conjunction with upstream reservoirs in providing flood protection at Cassville, Missouri.

(8) Recreation and fish and wildlife measures consisting of preservation of additional Ozark streams, stream access, preservation of high-quality wildlife habitat, and additional impoundments for fishing.

(9) Continued development of previously constructed projects to their optimum recreation capacity.

(10) Continued implementation and maintenance of established water quality control standards for protection of fish and wildlife and other purposes.

(11) Augmentation of low flow for certain Ozark streams to increase flows for float fishing and other recreational purposes.

37. SUMMARY OF PROJECTS AND PROGRAMS IN THE COMPREHENSIVE PLAN

The projects and programs in the comprehensive plan of development for the White River Basin are presented in Table 50 and are shown in general on Plate 1.

TABLE 50

COMPREHENSIVE PLAN OF DEVELOPMENT
WHITE RIVER AND TRIBUTARIES

MAIN STEM AND MAJOR TRIBUTARY RESERVOIRS
CORPS OF ENGINEERS

Project	Stream	Mile	Total drainage area (square miles)	Total storage capacity (acre-feet)	Purpose
	Existing Reservoirs				
Beaver	White River, Ark.	609.0	1,186	1,952,000	FC,P,WS
Table Rock	White River, Mo.	528.8	4,020	3,462,000	FC,P
Bull Shoals	White River, Ark.	418.6	6,036	5,408,000	FC,P
Norfork	North Fork River, Ark.	4.8	1,806	1,983,000	FC,P
Greers Ferry	Little Red River, Ark.	79.0	1,146	2,844,000	FC,P
Clearwater	Black River, Mo.	257.4	898	413,000	FC
	Recommended Additions for Inclusion in 10- to 15-year Plan				
County Line	James River, Mo.	107.8	153	282,000	FC,WS,WQ, R,F&W
Wolf Bayou	White River, Ark.	311.4	10,796	619,000	FC,P,R,F&W
Norfork, Power Units 3 and 4	North Fork River, Ark.	4.8	-	-	P (addition)
Myatt Creek	Myatt Creek, Ark.	2.2	142	140,000	FC,R,F&W
Wild Horse	South Fork of Spring River, Ark.	14.9	296	345,000	FC,R,F&W
Bell Foley (1)	Strawberry River, Ark.	27.2	519	518,000	FC,R,F&W
Quarry (Reregulation)	Little Red River, Ark.	64.3	1,210	7,400	R,F&W

Footnote is shown at end of table.

TABLE 50 (con.)

LEVEES AND CHANNEL IMPROVEMENTS
CORPS OF ENGINEERS

Project	Stream	Mile	Length (miles)	Area benefited (acres)	Purpose
Existing, Under Construction, and Authorized					
Poplar Bluff and East Poplar Bluff, Mo.	Black River	-	4.4	(2) 720	FC (Levee)
Black River, Poplar Bluff, Mo., to Knobel, Ark. (Ark. Portion)	do	140-173	37.5	71,040	FC (Levee & pump station)
Skaggs Ferry, Black River east of Pocahontas, Ark.	do	94-104, 81-84	8.8	13,931	FC (Levee)
Newport, White River, Ark.	White River	257.6	8.5	(2) 2,000	Do.
Village Creek, White River and Mayberry Levee Districts, Ark.	do	231.5-255	20.2	33,400	Do.
Augusta to Clarendon Levee, White River, Ark. (3)	do	108-197	39.4	217,000	Do.
Des Arc, Ark.	do	147.3	1.5	(2)	FC (Levee & pump station)
DeValls Bluff, Ark.	do	125.0	0.1	(2)	Do.
Clarendon City Levee, Ark.(4)	do	100.6	6.0	(2)	FC (Levee)
White River Backwater Levee, Ark.	do	-	40.0	145,500	FC (Levee & pump station)
Village Creek, Jackson and Lawrence Counties, Ark.	Village Creek	-	-	-	FC (Channel improvement)
Village Creek, White River and Mayberry Levee Districts, Ark.	White River	-	-	-	FC (Channel improvement & pump station)
Clarendon to Laconia Circle, Ark.	do	-	48.5	287,600	FC (Levee)
Cache River Basin, Ark.	Cache River and Bayou DeView	-	-	-	FC (Channel improvement)
Big Creek and L'Anguille River, Ark.	Big Creek & L'Anguille River	-	3.3	60,000	FC (Levee)
Big Creek and Tributaries, Ark.	Big Creek and Tributaries	-	-	-	FC (Channel improvement)

Footnotes are shown at end of table.

TABLE 50 (con.)

Project	Stream	Mile	Length (miles)	Area benefited (acres)	Purpose
Recommended Additions for Inclusion in 10- to 15-year Plan					
Black River-Cane Creek, Butler County, Mo., and Clay County, Ark.	Black River Cane Creek	158-211 3-18	62.8	75,000	FC (Levee & channel improvement)
Little Black River, Butler & Ripley Counties, Mo., & Clay and Randolph Counties, Ark.	Little Black R.	0-32	21.4	37,500	FC (Levee)
Current-Little Black Rivers, Ripley County, Mo., Clay County, Ark.	Current R. Little Black R.	28-35 1-15	14.3	5,800	Do.
Black-Current-Fourche Rivers, Randolph County, Ark.	Current R. Black R. Fourche R.	0-28 93-96 0-6	30.7	20,400	Do.
Flat Creek, Lawrence County, Ark.	Black River	51-66	15.2	6,000	FC (Levee & channel improvement)
Clover Bend, Lawrence, Jackson, and Independence Counties, Ark.	Black River Big Running Water Cr.	25-54 0-14	33.1	17,000	Do.
Black-Strawberry Rivers, Lawrence & Independence Counties, Ark.	Black River Strawberry River Curia Creek Ditch	33-44 0-9 0-3	14.1	9,000	Do.
Curia Creek, Independence County, Ark.	Black River Dota Creek Curia Creek Ditch	7-33 0-2 0-3	20.8	20,700	FC (Levee)
Oil Trough to Hurricane Lake, Independence, Jackson, & White Counties, Ark.	White River	199-282	45.1	55,000	FC (Levee & channel improvement)
Jacksonport, Jackson County, Ark.	White River Black River	258-265 0-1	6.0	2,400	FC (Levee)
Taylor Bay to Augusta, Woodruff County, Ark.	White River	203-232	15.9	19,300	FC (Levee & pumping sta.)
Little Red-White Rivers, White and Prairie Counties, Ark.	Little Red River White River Raft Creek	0-15 164-182 0-15	33.3	29,000	FC (Levee & channel improvement)
Bayou Des Arc, Prairie and White Counties, Ark.	Bayou Des Arc	4-22	13.0	36,000	FC (Channel improvement)

TABLE 50 (con.)

OTHER PROJECTS
CORPS OF ENGINEERS

Project	Stream or location	Status	Purpose
		Authorized	
Grand Prairie Region, Ark.	Grand Prairie Region, Lower White River Basin	Authorized by Flood Control Act of 1950; no works of improvement completed	Supplemental irrigation water to area of critical water shortage.
	Recommended in Prior Report (10- to 15-year Plan)		
Crooked Creek, at and in the vicinity of Harrison, Ark.	Crooked Creek	Pending congressional action	Reservoir on East Fork for flood control, water supply, and recreation; improvements to existing levee and floodwall at Harrison.
	Recommended for Further Study (10- to 15-year Plan)		
Navigation	White River, mouth to Batesville, Ark.	Separate study authorized by Senate Public Works Committee Resolution adopted 25 May 1967	Year-round 9-foot navigable channel.
Optimus, Pumped-Storage	White River, adjacent to Wolf Bayou Reservoir, river mile 348	Separate study recommended to verify engineering feasibility and economic justification	Approximately 500,000 kilowatts of pumped-storage hydroelectric power.

TABLE 50 (con.)

LAND TREATMENT PROGRAM
DEPARTMENT OF AGRICULTURE

Basin	Watershed area (acres)	Land treatment areas: Cropland (acres)	Grassland (acres)	Woodland (acres)	Recreation (acres)	Wildlife (acres)
	Existing and Authorized for Installation in PL 566 Program					
White River	1,235,000	252,200	139,700	88,500	8,100	12,310
	Recommended Additions for Inclusion in 10- to 15-year Plan					
White River	16,534,400	3,388,000	4,051,700	928,800	18,090	510,980

TABLE 50 (con.)

UPSTREAM WATERSHED PROJECTS
SOIL CONSERVATION SERVICE

Watershed			Structural measures			
Project	Number	Watershed area (acres)	Detention (number)	Recreation and M & I water supply (number)	Multiple-purpose (number)	Channel improvement (miles)
Public Law 566 Projects Authorized for Construction						
Upper Crooked Creek	28	56,320	19	-	-	-
Mud Creek	46	18,560	1	-	-	29.9
Big Running Water Ditch	69	80,000	-	-	-	82.2
Flat Creek	80	23,680	5	-	1	10.2
Cooper Creek	86	40,320	9	-	-	3.8
Upper Culotches Bay	116	39,040	-	-	-	50.2
Big Creek-Bayou DeView	117	72,960	22	-	-	8.8
Lee-Phillips	126	83,200	-	-	-	110.0
White River Backwater	131	145,920	-	-	-	165.0
Public Law 566 Projects Authorized for Planning						
Little Black River	65	247,680	39	-	-	61.4
Fourche Creek	67	199,040	24	-	-	30.1
Tri-County	87	228,480	31	-	-	57.3
Upstream Watershed Additions Recommended for Inclusion in 10- to 15-year Plan						
Upper White River	1	174,720	30	-	1	-
West Fork of White R.	3	78,080	11	-	3	-
Richland Creek	4	94,080	13	-	1	-
War Eagle Creek	6	209,920	21	-	1	-
Upper Kings River	8	106,880	13	-	1	-
Lower Kings River	9	135,040	-	1	-	-
Dry Fork-Kings River	10	33,280	5	-	-	-
Osage Creek	11	104,960	5	-	1	-
Lower James River	15	193,920	31	-	-	-
Flat Creek	16	200,960	8	-	-	-
Indian Creek	18	40,320	2	-	-	-
Long Creek	19	99,200	8	-	1	-
Yokum-Dry Creeks	20	88,320	10	-	-	-
Bull-Swan Creeks	22	241,920	-	1	-	-

TABLE 50 (con.)

Watershed			Structural measures			
Project	Number	Watershed area (acres)	Detention (number)	Recreation and M & I water supply (number)	Multiple-purpose (number)	Channel improvement (miles)
Upstream Watershed Additions Recommended for Inclusion in 10- to 15-year Plan (con.)						
White River-Bull Shoals Dam to below mouth of Crooked Cr.	27	71,040	1	-	-	-
Big Richland Creeks	32	243,200	12	-	-	-
Middle Buffalo River	33	208,000	6	-	1	-
Upper North Fork R.	35	136,320	-	1	-	-
Lower North Fork R.	36	227,840	-	1	-	-
Lower Norfork Reservoir Tributaries	40	208,000	22	-	-	-
Salado Creek & Main Stem Laterals	44	111,360	15	-	3	(5) 7
Polk Bayou & Main Stem Laterals	45	140,800	10	-	-	-
Upper Black and Clearwater Laterals	47	249,600	-	2	-	-
West Fork of Black R.	48	102,400	-	1	-	-
Black River-Clearwater Dam to Poplar Bluff	51	222,080	47	-	1	-
North Inter-River Drainage District	52	99,200	-	-	-	161
Cane Creek & Black River Main Stem	53	219,520	31	-	2	190
Corning Ditches	55	62,080	-	-	-	165
Upper Current River	56	241,280	7	-	-	-
Current River-Akers to Jacks Fork	57	196,480	-	3	-	-
Spring Valley Creek	58	92,800	5	-	-	-
Upper Jacks Fork	59	120,960	9	-	-	-
Pike Creek	62	92,800	25	-	-	-
Current River-Van Buren, Mo., to Buffalo Creek	63	207,360	10	-	-	-
Lower Current River	64	120,320	8	-	-	-
Black Creek	66	26,880	-	-	-	38
Little Running Water Ditch	68	12,800	-	-	-	41
Upper Spring River	70	165,760	36	-	1	-

Footnote is shown at end of table.

TABLE 50 (con.)

Watershed			Structural measures			
Project	Number	Watershed area (acres)	Detention (number)	Recreation and M & I water supply (number)	Multiple-purpose (number)	Channel improvement (miles)
Upstream Watershed Additions Recommended for Inclusion in 10- to 15-year Plan (con.)						
Myatt Creek & Middle Spring River	71	179,840	23	-	-	-
South Fork Spring R.	72	210,560	25	-	1	-
Lower Spring River	73	221,440	35	-	2	-
Upper Eleven Point R.	74	199,680	32	-	1	-
Middle Eleven Point R.	75	53,120	15	-	1	-
Eleven Point River-Alton Reach	77	155,520	22	1	1	-
Eleven Point Laterals	78	102,400	25	-	1	-
Lower Eleven Point R.	79	28,160	6	-	-	-
Big Cypress Creek	81	27,520	1	-	-	-
Lower Black River Main Stem	82	26,880	-	-	-	25
Upper Strawberry River	83	151,680	28	-	1	-
Piney Fork-Strawberry River	84	75,520	20	-	-	-
North Big Creek-Strawberry River	85	122,880	1	-	-	-
Upper Village Creek	88	106,880	-	-	-	121
Lick Pond Ditch	89	27,520	-	-	-	43
Village Creek-Swan Pond Reach	90	67,840	-	-	-	74
Lower Village Creek (Mayberry)	91	83,200	-	-	-	73
Departee Creek & White River Laterals	92	224,000	15	-	3	68
Middle Fork-Little Red River	94	188,800	22	-	4	-
Big Creek and Main Stem, Little Red R.	100	204,800	14	-	1	-
Indian Creek-Little Red River	101	96,000	12	-	2	-
Overflow Creek-Little Red River	102	39,040	2	-	-	16
Cypress Bayou	103	154,240	4	-	-	90
Bull Creek	104	100,480	17	-	1	46
Upper Des Arc Bayou	105	124,160	7	-	-	55
Lower Des Arc Bayou	106	116,480	-	-	-	36

TABLE 50 (con.)

Watershed			Structural measures			
Project	Number	Watershed area (acres)	Detention (number)	Recreation and M & I water supply (number)	Multiple-purpose (number)	Channel improvement (miles)
Upstream Watershed Additions Recommended for Inclusion in 10- to 15-year Plan (con.)						
White River-DeValls Bluff to St. Charles	108	162,560	-	-	-	15
Upper Cache River (Ditch No. 1)	109	175,360	44	-	-	179
Lower Cache (Ditch No. 1)	110	160,640	33	-	-	183
Cache River-Egypt to Light	111	102,400	9	-	-	140
Cache River-Amagon to Egypt	112	106,240	-	-	-	152
Cache River-Patterson to Amagon	113	117,120	-	-	-	166
Overcup Ditch	114	22,400	-	-	-	32
Cache River-Clarendon to Patterson	115	127,360	-	-	-	138
Bayou DeView-Flag Slough Reach	118	121,600	-	-	-	116
Lower Bayou DeView	119	210,560	-	-	-	189
Cow Lake	120	28,160	-	-	-	40
Possum Creek	121	10,880	-	-	-	18
Dials Creek	122	30,080	-	-	-	54
Big Slash	123	21,120	-	-	-	35
Big Creek-Flat Fork Reach	124	106,240	-	-	-	110
Big Creek-Piney Fork Reach	125	179,200	-	-	-	211
Lower Big Creek	127	181,760	-	-	-	133
Big Cypress-Big Creek	128	85,120	-	-	-	124
Lower White River Tributaries	130	192,000	-	-	-	49
Big Bayou LaGrue	132	163,840	-	-	-	106
Little Bayou LaGrue	133	86,400	-	-	-	55
Dismal Swamp	B	44,800	-	-	-	23

TABLE 50 (con.)

RECREATION AND FISH AND WILDLIFE IMPROVEMENTS

Project	Number	Administrative agency	Land (acres)	Water (acres)	Activity
		Existing, Under Construction, and Authorized			
		Federal			
Ozark National Scenic Riverways	1	National Park Service	86,924	-	R, F
National Forests	3	U. S. Forest Service	1,207,665	-	R, H, WP
National Wildlife Refuge	1	U. S. Fish and Wildlife Service	112,653	3,517	F, H, WP
Federal Fish Hatcheries and Experimental Stations	4	do	-	-	FP
		State			
Public Hunting Areas	8	Ark. Game & Fish Commission	97,900	15,600	F, H, WP
	6	Mo. Conservation Commission	107,895	900	Do.
Wildlife Management Areas	5	Ark. Game & Fish Commission	6,980	-	WP
	5	Mo. Conservation Commission	37,217	40	F, WP
Public Fishing Lakes	8	Ark. Game & Fish Commission	100	2,389	F
	3	Mo. Conservation Commission	190	86	F&H
State Fish Hatcheries	3	Mo. Conservation Commission (Trout production)	-	-	FP
Trout Management Areas	7	Ark. Game & Fish Commission	-	42,210	F
	7	Mo. Conservation Commission	-	2,255	F
Public Access Areas	21	Ark. Game & Fish Commission	80	-	F
	5	Mo. Conservation Commission	641	-	F
Public Parks	7	Ark. Publicity and Parks Commission	3,844	20	R, F, WP
	7	Mo. State Parks Board	12,983	100	R, F, WP
		Municipal or Local			
City Fishing Lakes	4	Municipality	2,881	1,465	R, F
City Parks	43	do	4,506	824	R
Total			1,682,459	69,406	

TABLE 50 (con.)

RECREATION AND FISH AND WILDLIFE IMPROVEMENTS

Project	Location	Water Miles	Water Acres	Land (acres)	Access sites (number)	Activity
Recommended Additions for Inclusion in 10- to 15-year Plan						
	Federal					
National Scenic Rivers:						
Current	Missouri	20	-	4,000	3	R,F&H,WP
Buffalo	Arkansas	128	-	103,000	13	Do.
Eleven Point	Missouri & Arkansas	90	-	29,000	10	Do.
National Recreation Area-1	do	-	-	-	-	Do.
National Forests:						
(Mark Twain & Clark)	Missouri					
Land acquisition	(Includes consolidation of holdings for preservation of six scenic areas)			285,300	-	R,H,WP
Recreation lakes - 10		-	880	-	10	R,F
Stream preservation:						
North Fork River		30	-	4,800	4	R,F,H
Beaver Creek		37	-	5,900	4	Do.
Little North Fork River		20	-	3,200	3	Do.
Roaring River		5	-	800	1	R,F
Hiking and saddle trails - 3		-	-	-	-	R
Scenic drives - 5						R
(Ozark-St. Francis)	Arkansas					
Land acquisition	(Includes consolidation of holdings for preservation of one scenic area)			73,000	-	R,H,WP
Scenic drive - 1		-	-	-	-	R
National Wildlife Refuge:						
(White River Refuge)	Arkansas					
Land acquisition		-	-	4,000	-	F,H,WP
Large Impoundments: (6)						
County Line	Missouri	-	5,010	830	5	R,F&H,WP
Myatt Creek	Arkansas	-	1,350	640	2	Do.
Wild Horse	do	-	4,240	2,150	5	Do.
Bell Foley	do	-	6,700	3,200	6	Do.
Wolf Bayou	do	-	11,760	5,410	9	Do.
Quarry	do	-	1,000	-	3	R,F

Footnote is shown at end of table.

TABLE 50 (con.)

Project	Location	Water: Miles	Water: Acres	Land (acres)	Access sites (number)	Activity
		Federal (con.)				
Tailwater Regulation:						
Myatt Creek	Arkansas	(Cold water release)			1	R,F
Wild Horse	do	(Warm water release)			1	R,F
Bell Foley	do	(do)			1	R,F
Wolf Bayou	do	(do)			1	R,F
Quarry	do	(Reregulation structure - cold water release)			1	R,F
County Line	Missouri	(Water quality control releases)			1	R,F
Small Impoundments (Watershed program)						
Multiple-purpose - 9	Missouri	-	1,379	-	9	R,F,H
Multiple-purpose - 10	Arkansas	-	2,090	-	10	R,F,H
		State				
Recreation Information Centers	Missouri & Arkansas	-	-	-	-	-
Stream Preservation:						
James River	Missouri	26	-	4,420	5	R,F,WP
Upper Black River	do	34	-	5,400	4	Do.
Bryant Creek	do	36	-	5,800	4	Do.
Bull Creek	do	10	-	1,600	2	Do.
Swan Creek	do	13	-	2,100	2	Do.
Kings River	Arkansas	40	-	6,400	5	Do.
War Eagle Creek	do	30	-	4,800	3	Do.
Spring River	do	25	-	4,000	3	Do.
Bear Creek	do	20	-	3,200	2	Do.
Archey Fork of Little Red River	do	32	-	5,120	4	Do.
Middle Fork of Little Red River	do	40	-	6,400	5	Do.
North Sylamore Creek	do	14	-	2,240	2	Do.
Big Creek above Bell Foley Reservoir	do	18	-	2,880	2	Do.
Richland Creek	do	24	-	3,840	3	Do.
Salado Creek	do	26	-	4,160	3	Do.

TABLE 50 (con.)

Project	Location	Water Miles	Water Acres	Land (acres)	Access sites (number)	Activity
	State (con.)					
Public Lakes:						
Shannon County	Missouri	-	150	-	1	R,F
Douglas County	do	-	150	-	1	R,F
Greene County	do	-	150	-	1	R,F
Montauk Park	do	-	150	-	1	R,F
Black River	Arkansas	-	800	-	2	R,F,H
Bayou DeView	do	-	300	-	2	Do.
Hurricane	do	-	800	-	2	Do.
Holman Creek	do	-	350	-	2	Do.
Spider Creek	do	-	150	-	1	R,F
Scenic Drives - 2	do	-	-	-	-	R
Trout Hatchery:						
Montauk Expansion	Missouri	-	-	-	-	FP
Wildlife Management Areas:						
Reach No. 20	Arkansas	-	-	8,000	-	H,WP
Reach No. 22	do	-	-	12,000	-	Do.
Reach No. 23	do	-	-	4,000	-	Do.
Other Access Facilities:						
Streams	Missouri	-	-	-	30	F
Do	Arkansas	-	-	-	43	F
	Municipal or Local					
Small Impoundments - 13	Arkansas	-	1,237	-	-	R,F
	Private Sector					
Service Industries	Missouri & Arkansas	-	-	-	-	R
Ozark Scenic Railway	do	-	-	-	-	R

TABLE 50 (con.)

Project	Location	Water		Land (acres)	Access sites (number)	Activity
		Miles	Acres			
	Private Sector (con.)					
Small Impoundments:						
Farm Ponds	Missouri	-	1,300	-	-	F
Do	Arkansas	-	5,400	-	-	F
FWR Structures - 321	Missouri	-	5,638	-	-	F&H
FWR Structures - 492	Arkansas	-	9,649	-	-	F&H
Irrigation Reservoirs - 5	do	-	634	-	-	R,F
Fish Farming	do	-	39,180	-	-	FP
Total		718	100,447	611,590	238	

TABLE 50 (con.)

MAIN STEM AND TRIBUTARY RESERVOIRS
CORPS OF ENGINEERS

Project	Location		Approximate total available storage (acre-feet)
	Stream	Mile	
	Long-range Plan		
Grandview, Ark.	Kings River	34.6	301,000
Kinser Bridge, Mo.	James River	96.7	136,000
Finley Creek, Mo.	Finley Creek	19.0	110,000
Galena, Mo.	James River	50.2	846,000
Crooked Creek. Ark.	Crooked Creek	26.0	250,000
Piney Creek, Ark.	Piney Creek	2.0	210,000
Polk Bayou, Ark.	Polk Bayou	5.0	80,000
Harviell, Mo.	Cane Creek	17.6	54,000
Fairdealing, Mo.	Little Black River	37.4	77,000
Doniphan, Mo.	Current River	55.0	(7) 0
Janes Creek, Ark.	Janes Creek	9.2	107,000

Footnote is shown at end of table.

TABLE 50 (con.)

LEVEES AND CHANNEL IMPROVEMENTS
CORPS OF ENGINEERS

Project	Location	Approximate length (miles)	Approximate acres benefited
	Long-range Plan		
Fayetteville, Washington County, Ark.	West Fork of White River at Fayetteville	3	200
Cassville, Barry County, Mo.	Flat Creek at Cassville	5	200
Big Bottom, Independence County, Ark.	Black and White Rivers at their confluence	22.2	18,000
Clinton, Van Buren County, Ark.	Archey Fork of Little Red River at Clinton	1	40
Clarendon to Laconia Circle (8)	White River below Clarendon	48.5	287,600

Footnote is shown at end of table.

TABLE 50 (con.)

UPSTREAM WATERSHED PROJECTS
SOIL CONSERVATION SERVICE

Watershed			Structural measures			
Project	Number	Watershed area (acres)	Detention (number)	Recreation and M & I water supply (number)	Multiple-purpose (number)	Channel improvement (miles)
		Long-range Plan				
Upper James River	12	172,800	36	-	1	-
Finley Creek	14	171,520	37	-	1	-
Beaver Creek	23	247,680	39	-	1	-
Little North Fork Laterals	26	236,800	19	-	-	-
Lower Crooked Creek	29	241,920	38	-	3	-
Big Richland Creeks	(9) 32	243,200	-	2	-	-
Upper North Fork River	35	136,320	9	-	-	-
Lower North Fork River	36	227,840	8	-	-	-
Upper Norfork Dam Tributaries	37	211,200	6	-	-	-
Upper Bryant Creek	38	218,240	11	-	-	-
Lower Bryant Creek	39	154,240	7	-	-	-
White R-North Fork R. to Sylamore Creek	41	226,560	24	2	-	-
Sinking Creek	49	54,400	14	-	-	-
Logan Creek	50	168,320	30	-	1	-
Pike Creek	(9) 62	92,800	-	1	-	-
Archey Fork & Laterals-Little Red River	97	104,320	2	-	2	-
Prairie Cypress-Big Creek	129	21,760	-	-	-	34
Lower White River Tributaries (9)	(10) 130	192,000	-	-	-	-

Footnotes are shown at end of table.

TABLE 50 (con.)

HYDROELECTRIC POWER

Project	Owner or agency	Stream and location	Remarks
		Long-range Plan	
Ozark Beach	The Empire District Electric Company	White River	Modification of existing project by addition of 24,000 kilowatts generating capacity.
Millers Point	Corps of Engineers	Little Red River adjacent to Greers Ferry Reservoir	Approximately 600,000 kilowatts pumped storage.

(1) Previously authorized for flood control only.
(2) Affords protection to property within city and adjacent area.
(3) Complete except for 6.6-mile section; information on area benefited based on completed project.
(4) Enlargement authorized by Flood Control Act of 1965.
(5) 6 miles of flood prevention; 1 mile flood prevention and water management.
(6) Includes lands acquired for other project purposes suitable for wildlife management.
(7) Major tributary floodwater retarding structure with no permanent pool.
(8) Levee project listed under authorized, but placed in long-range plan because of lack of local interest.
(9) Watershed listed in 10- to 15-year plan.
(10) 13 miles of irrigation canals with pumping station.

LEGEND:
FC - Flood control
P - Hydroelectric power
WS - Municipal and industrial water supply
WQ - Water quality control
R - Recreation
F&W - Fish and wildlife
F - Fishing
H - Hunting
FP - Fish production
WP - Wildlife production

38. GENERAL

A discussion of the water and related land resource needs of the basin that would not be met by the existing, under construction, and certain authorized and proposed projects and programs was presented in Section III of this report. This section (VIII) presents data and discusses the effects the projects and programs in the 10- to 15-year category of the comprehensive plan will have on these needs.

39. FLOOD CONTROL AND PREVENTION

a. The estimated average annual flood losses that would be prevented by all the flood control and prevention projects in the 10- to 15-year plan are summarized in Table 51. The effects of land treatment on flood losses were not considered in making these estimates. Future economic conditions that are expected without additional water resource investments were considered in estimating the values shown.

TABLE 51

AVERAGE ANNUAL FLOOD LOSSES PREVENTED

Means of prevention	Amount
Major reservoirs	$7,591,000
Floodwater retarding structures	8,162,000
Local flood protection projects	10,218,000
Multiple-purpose channels	8,739,000
Total for basin	34,710,000

b. The areal effects of flood control and prevention have been summarized in Table 52 by three natural and significant sub-basin areas and by physiographic provinces. Also shown are the average annual losses with the existing, under construction, and certain authorized and proposed projects functioning; the average annual losses prevented by the projects included in the 10- to 15-year plan; the remaining average annual losses; and the percent of losses prevented.

c. Areas damaged by floods in the Ozark Plateaus are widely scattered and generally not large enough to justify the cost of the projects required to alleviate the conditions, therefore, the losses that would be prevented are about as great as can be expected. In some watersheds only a very few structures are found to be feasible. The most successful application of the upstream watershed projects was in the Black River area where the topography is not as rugged as in the Upper White River Basin.

TABLE 52

FLOOD CONTROL EFFECTS BY AREAS
(In thousands of dollars)

Area	Average annual flood losses			Percent of
	Base condition	Modified by 10- to 15-yr. plan	Prevented by 10- to 15 yr. plan	base condition losses prevented
Upper White River:				
Ozark Plateaus	$6,527	$4,995	$1,532	23
Coastal Plain	308	177	131	43
Total	6,835	5,172	1,663	24
Black River:				
Ozark Plateaus	6,522	4,384	2,138	33
Coastal Plain	31,601	17,668	13,933	44
Total	38,123	22,052	16,071	42
Lower White River:				
Ozark Plateaus	1,834	1,225	609	33
Coastal Plain	50,328	33,961	16,367	33
Total	52,162	35,186	16,976	33
Subtotals:				
Ozark Plateaus	14,883	10,604	4,279	29
Coastal Plain	82,237	51,806	30,431	37
Basin Total	97,120	62,410	34,710	36

d. In the Coastal Plain area the base condition average annual flood losses amount to $35,785,000 from overflow of the main stems of the lower Black and White Rivers. Major reservoirs and local flood protection projects in the 10- tc 15-year plan would reduce these losses by $7,321,000 and $10,218,000, respectively, for a total of $17,539,000 or a 49 percent reduction. Floodwater retarding structures would further reduce these losses along the main stems by about $1,150,000. Total losses prevented by all measures would be $18,689,000 which is about a 52 percent reduction. The remaining losses would occur on the riverside of leveed areas and on low areas in tributary bottoms which are affected by backwater from the main stem of the Black or White Rivers and which are not feasible to protect by levees or reservoirs.

e. In the Coastal Plain area about $46,000,000 of the average annual flood losses are found along tributary streams and are caused by runoff originating in the Coastal Plain. Very little of such runoff can be controlled by reservoirs although several floodwater retarding structures that would be located in the Crowley's Ridge area are in the 10- to 15-year plan and would effect some control. Most of the annual flood control benefits of $8,739,000 attributable to multiple-purpose channels are located along small tributaries in the Coastal Plain area.

40. DRAINAGE

a. There are an estimated 1,646,683 acres of cropland in the basin which are classified as having a wetness hazard. Of this total cropland acreage, 1,589,342 acres are in the Coastal Plain area and 57,341 acres are in the Ozark Plateaus area.

b. Planned channels would provide for the orderly disposal of excess rainfall and would reduce the amount of damage by providing sufficient channel capacity to confine the water to the channel for the designed level of protection. Adequate outlet ditches would also be provided for the extensive system of group and on-farm drainage ditches required in the area for more efficient agricultural water management.

c. Drainage investigations revealed that 3,511 miles of multiple-purpose flood control and agricultural water management channels should be included in the 10- to 15-year plan. Installation of these channels would provide average annual drainage benefits of $9,343,500 to 1,531,848 acres of cropland, or 93 percent of the cropland having a wetness hazard for agricultural production. Channels were planned to benefit only the cropland acreage and those areas which were not subject to frequent overbank flooding.

41. WATERSHED PROTECTION

a. There are about 8,898,000 acres of land throughout the basin not included in existing and authorized Public Law 566 projects that have lost much of their productive capacity due to improper management and exploitation. About 3,388,000 acres are cropland, 4,052,000 are grassland, 929,000 are forest land, 18,000 are recreation, and 511,000 are fish and wildlife habitat. The 10- to 15-year plan provides for proper treatment of this land to rebuild it to a productive state.

b. The primary effects of watershed protection measures are to reduce erosion, retard surface runoff and reduce peak flows from small areas, and improve the soil profile. The establishment of these conservation practices will not reduce the water yield measurably within the White River Basin.

c. Reducing erosion keeps the soil on-site, thus building deeper and more productive soil profiles. This prevents sediment from entering waterways and improves drainage conditions. It also helps keep streams clear which makes them better habitat for fish and more attractive for recreation. Deep soils contain more humus and are easier tilled than shallow soils. They also retard surface runoff and thus reduce peak flows from small areas, especially for small storms occurring when the soil is unsaturated.

d. Watershed protection measures on forest lands also benefit recreation by providing improved ground cover and forests for more aesthetically desirable sites and terrain. These measures improve wildlife habitat by providing increases in both food and cover.

e. Studies on many small watersheds show that the application of watershed protection measures increase total benefits resulting from Public Law 566 watershed protection and flood prevention programs by about 3 percent. These benefits were not used in the evaluation of projects in this report.

42. WATER AVAILABILITY

a. Available supplies of water in the White River Basin are adequate to satisfy all present and foreseeable future needs when considering the basin as a whole. There are some localized areas in the upstream portions of the basin where some cities or communities are now or will experience water shortages if facilities are not expanded. In most cases, the present shortages are due to inadequate facilities rather than an unavailable supply of water.

b. The 10- to 15-year plan would provide future water supply for the city of Springfield, Missouri, from the multiple-purpose County Line Dam and Reservoir on the upper James River. Also in this plan are 11 multiple-purpose projects in the Public Law 566 program and one single-purpose upstream project that would provide water supply for a like number of small towns and communities in the basin.

c. The major withdrawal use of water in the future will be for irrigation. In 1965, approximately 564,000 acres of land were irrigated with by far the largest majority of these acres being located in the Coastal Plain portion of the basin. It is expected that small tracts of land in the upland portions of the basin will be irrigated in the future. Generally these upland areas will be irrigated by sprinkler systems with water to be provided by 5 multiple-purpose upstream watershed projects that are in the 10- to 15-year plan.

d. A diminishing ground-water aquifer will make the planned diversion of White River water to the Grand Prairie area (a part of which is in the White River Basin) an economic necessity if the area is to continue to grow rice as it has in the past. The authorized Grand Prairie agricultural water supply project included a canal with a capacity of 2,200 c.f.s. from the White River at DeValls Bluff to project lands southwest of the point of diversion. The irrigation needs estimated for this study indicate that a diversion of 4,520 c.f.s.

will be required by 1980 in the DeValls Bluff reach of the White River with the major portion of this going to the Grand Prairie. When advance planning funds are made available for the authorized project, consideration will be given to these additional water requirements.

e. Additional irrigation will develop in the Coastal Plain area, but it is expected that development will be by individual or private cooperatives. Because of the available supply of water in the Black and White Rivers, these additional requirements will be met from these sources.

f. To determine the adequacy of the water supply available in the future, a supply-demand comparison was made. This comparison was limited to Coastal Plain reaches of the Black and White Rivers, as the County Line project and upstream watershed projects would meet the needs of the water shortage areas in the upland reaches. It has been assumed that the future available supply will be the flows with the existing and 10- to 15-year reservoir projects in operation. Demand is the total expected streamflow diversions for rural, municipal, and industrial water supply, irrigation, fish-farming, and other uses. For purposes of this supply-demand study, consumptive use, return flow, and re-use factors were not evaluated. The supply-demand comparison is shown in Table 53.

g. Except for the large diversion of irrigation water from the White River in the vicinity of DeValls Bluff, withdrawals from streamflow are minor when compared to low flow. It should be further noted that only a portion of withdrawals are actually consumptive use, and that usually a greater part of withdrawals return to the parent stream and can be re-used if necessary. In the White River Basin the principal re-use of water would be for generation of hydroelectric power or navigation on the lower White River. Total expected withdrawals above existing and planned hydroelectric plants in the basin are small. Actual streamflow depletion above these plants, due to consumptive use, would be insignificant. It is noted further that, except for the small amount of evaporation losses that might result from storage in a forebay reservoir, generation of power by pumped-storage projects is not a consumptive use of water.

h. The diversion at DeValls Bluff for irrigation would have a material effect on open channel navigation below that point. The supply-demand comparison indicates that from 7,000 to 8,000 c.f.s. would remain in the channel below the DeValls Bluff diversion. Only a portion of the water diverted at this point would return to the White River as it is expected that much of the return flow will enter tirbutaries

TABLE 53

WATER SUPPLY-DEMAND COMPARISON
(Flows in c.f.s. and m.g.d.)[1]

Period	Black River											
	Corning, Ark.						Black Rock, Ark.					
	Available supply		Demand		Flow in excess of demand		Available supply		Demand		Flow in excess of demand	
	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.
1980	314	201	46	29	268	171	1,965	1,260	68	41	1,897	1,216
2000	314	201	64	41	250	160	1,947	1,248	90	58	1,857	1,190
2020	314	201	77	49	237	152	1,934	1,240	106	68	1,828	1,172
	White River											
	Newport, Ark.						DeValls Bluff, Ark.					
	Available supply		Demand		Flow in excess of demand		Available supply		Demand		Flow in excess of demand	
	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.	c.f.s.	m.g.d.
1980	10,254	6,573	125	80	10,129	6,493	12,548	8,043	4,657	2,985	7,891	5,058
2000	10,166	6,517	157	100	10,009	6,416	12,428	7,967	4,780	3,064	7,648	4,902
2020	10,084	6,464	175	112	9,909	6,352	12,328	7,902	4,950	3,173	7,378	4,729

(1) Cubic feet per second and million gallons per day.

of the Arkansas River to the south of the Grand Prairie area. The 7,000 to 8,000 c.f.s. is insufficient flow, in this reach, to maintain a desirable navigable depth in the channel. This situation would not materially improve after the irrigation season, because at that time upstream hydroelectric power operations are reduced, thereby reducing outflow from the reservoirs. Flow in the lower White is then limited to these releases plus the runoff from the intervening drainage area below the reservoirs. Flows in the White River Basin are generally at their lowest during the late summer or early fall months.

i. If the reservoir projects included in the 10- to 15-year plan are constructed with proper utilization of ground water, return flows, and pollution control measures, sufficient water resources will be available to meet all foreseeable water supply needs to the year 2020.

43. WATER QUALITY CONTROL

a. The 10- to 15-year plan provides for reservoir storage for pollution abatement in two Federal projects in the upper basin -- the multiple-purpose County Line Reservoir of the Corps of Engineers on the James River and the multiple-purpose Soil Conservation Service reservoir in Watershed No. 3 of the West Fork of the White River. Supplemental and regulated flow releases from the County Line Reservoir would maintain uniform flows and also improve water quality by assimilating municipal and industrial effluents and pollution from other sources in the James River from the dam site east of Springfield, Missouri, to the headwaters of Table Rock Reservoir. The Soil Conservation Service reservoir would provide the same benefits in the reach of the White River from the Fayetteville, Arkansas, area to the headwaters of Beaver Reservoir.

b. The two projects will assure adequate flows in the receiving streams to properly assimilate treated waste discharges from the two largest cities and industrial areas of the basin. Higher dissolved oxygen levels will be maintained which are essential for the propogation of fish and wildlife. By providing reservoir releases during summer months when water quality control needs are most severe, sufficient flow of acceptable quality will be maintained in the streams to permit higher species of game fish to live in the area and to protect and enhance use of the streams and the headwaters of the reservoirs for sport fishing. Assured water quality will provide favorable conditions for general recreation use of the streams, particularly by those living in and near the two metropolitan areas. The riparian property owners and all other users of the stream will enjoy improved aesthetics, clean surface waters, and a satisfactory public health water environment.

c. Except in specific areas described in Appendix N where supplemental flows and other pollution-control measures have been proposed, waste discharges resulting from municipal and industrial development are not expected to be of the magnitude or type to measurably deteriorate stream quality. Even the low flows of the White River and its major tributaries are sufficient to assimilate all anticipated future waste discharges, adequately treated, without any significant quality degradation.

44. HYDROELECTRIC POWER

The amounts of hydroelectric power capacity that could be used in the Federal Power Commission Coordination Area K on the peak August load to effect a balanced system with other types of power generation, in addition to the capacity of existing and scheduled facilities, are 4,240,000 kilowatts by 1980, 14,240,000 kilowatts by 2000, and 29,640,000 kilowatts by 2020. The amounts of these capacities that could be in adjoining pumped-storage facilities were estimated to be 2,670,000, 6,920,000, and 13,540,000 kilowatts in 1980, 2000, and 2020, respectively. The 10- to 15-year plan provides for the installation of 265,000 kilowatts of conventional hydroelectric capacity and 500,000 kilowatts of pumped-storage capacity in the White River Basin. Some of the hydroelectric power needs may be met by conventional and pumped-storage projects in other river basins in Area K. The conventional hydroelectric power sites that could be developed to supply the estimated demand in Federal Power Commission Coordination Study Area K are far inadequate for meeting the needs. However, the extent to which this inadequacy can be supplied by the pumped-storage potential development has not been fully determined.

45. FISH AND WILDLIFE

a. The Corps of Engineers reservoir projects will satisfy the additional demand for warm water type fishing on large impoundments beyond the year 2020 in Arkansas and up to the year 2000 in the Missouri part of the basin. Additional local needs for fishing on small impoundments can be adequately satisfied in both Arkansas and Missouri throughout the period of analysis (2020) by the Soil Conservation Service, State, and private sector projects included in the 10- to 15-year plan. Trout-fishing opportunities will be increased sufficiently to satisfy demand up to the year 2000 as a result of habitat improvement and the anticipated increase in the trout-stocking program. Improved water-quality-control standards will enhance fishery-habitat conditions in many of the natural lakes and streams in the basin. Future demand for fishing on Ozark streams cannot be sufficiently satisfied beyond 1980 because of the limited supply and irreplaceable nature of this type of resource habitat. However, increased use of these streams for

fishing will be realized by expansion of the access system on these and other major streams in the basin, which is a part of the 10- to 15-year plan.

b. Future hunting demand can be satisfied only through intensive wildlife management, habitat improvement, and access to the public and privately owned lands. Public lands acquired in fee-title or by easements for other project and program purposes, and made available for hunting, could satisfy approximately 35 percent and 60 percent of the hunting needs anticipated by 1980 in Arkansas and Missouri, respectively. By 2000 the public lands are expected to furnish 17 percent of the total supply needed in Arkansas. Publicly owned lands in Missouri could satisfy 28 percent of the hunting demand by 2020. Land-use conversion and loss of high-quality wildlife habitat on private sector lands will reduce the capacity for wildlife production below the level required to satisfy the continued increase in hunting after the year 2000 in Arkansas, and the year 2020 in Missouri. Continued pressure exerted on the wildlife resources beyond these dates will result in lowering the quality of hunting.

c. Protection and preservation of unique and scenic environmental areas associated with the Ozark streams, National Forest lands, State wildlife management areas, and other developments included in the 10- to 15-year plan, will provide additional opportunities for bird-watching and wildlife photography throughout the basin. Conditions for protecting rare and endangered species and other unusual forms of wildlife will be greatly enhanced, and the continued importance of the intangible values will be safeguarded in future years.

d. Continued growth of commercial fish-farming operations and increased harvest of commercial fishery products from natural streams and lakes and impounded waters in the basin will provide considerable economic gain in future years. For example, if the estimated market requirements for 1980 are met, commercial fish-farming production would be valued at approximately $18 million, based on current prices. Additional economic importance will accrue from the increased harvest of commercial fishery products in other waters of the basin.

e. There would be losses in upland game-hunting opportunities resulting from loss of habitat that would be inundated by the projects if these losses are not mitigated. The loss would amount to about 6,300 man days on 25,900 acres inundated by the Corps of Engineers reservoirs and 5,500 man days on 21,501 acres inundated by the Soil Conservation Service small impoundments. Justifiable mitigation measures will be included in Corps of Engineers projects. In view of the fact that the land required for small impoundments will remain in private ownership, the Soil Conservation Service will encourage the owners to mitigate the losses attributable to the small impoundments.

46. RECREATION

a. Recreational projects and facilities in the Comprehensive Plan of Development are generally of two types -- those for aesthetic and physical enjoyment, and those of historical or cultural interest. For both of these types, the plan includes expansion or improvement of existing facilities and the development of new areas to meet the needs of the wilderness visitor and the vacationer, as well as the growing number of urban dwellers who seek relaxation close to home from the pressures of everyday life in a variety of outdoor activities.

b. The recreation features of the 10- to 15-year plan are estimated to supply about 8,255,500 recreation days. This is 87 percent of the 1980 needs for the four major outdoor recreation activities -- boating, swimming, camping, and picnicking. The needs satisfied by the establishment of free-flowing streams, scenic drives, scenic areas, hiking and saddle trails, and from recreational development by the private sector, are not included in this estimate.

c. The need for recreation facilities in the years after 1980 are expected to increase as the population and their incomes increase. A portion of this increased demand may be satisfied by expansion of both existing facilities and the facilities included in the 10- to 15-year plan.

d. The plan would meet a large part of the demand for recreational activities and enhance the area tourist industry. Implementation of the recreational parts of the plan would also enhance the basin land and water resources and encourage their continued use and appreciation.

SECTION IX - ECONOMIC EVALUATION OF PROJECTS IN THE 10- TO 15-YEAR PLAN

47. GENERAL

a. The evaluation and justification of projects and programs included in the 10- to 15-year plan have been in accordance with authority, policy, and procedures of the agency that would be responsible for implementing the applicable features of the plan. Monetary evaluations of tangible costs and benefits have been made for main stem and major tributary reservoirs, local protection levee and channel improvement projects, and upstream watershed projects. However, intangibles were given full consideration in formulating these projects. Other features of the plan such as national scenic rivers; stream preservation; archaeologic, historic, and natural science values; and other specific recreation and fish and wildlife proposals, have been evaluated on the basis of tangible and intangible values. It has been assumed that these projects and programs have benefits at least equal to their costs. The primary responsibility for development of these measures, except for the Fish and Wildlife Service and the United States Forest Service, is with the States, municipalities, and private sector, and they are responsible for the final decisions concerning economic justification. Economic evaluation of the land treatment program is not required by existing legislation.

b. The following standards were guidelines in the formulation of projects in the 10- to 15-year plan:

(1) The project must provide a practical and economic solution of fulfilling an existing or prospective need;

(2) Each project purpose considered must provide benefits at least equal to the cost of including that purpose in the plan;

(3) The total evaluated benefits to be obtained from the project must exceed total economic costs;

(4) There is no more economical means evaluated on a comparable basis of accomplishing the same purpose, which would be precluded from development if the project were undertaken; and

(5) Where other considerations do not limit scale of development the project selected should provide for a maximum excess of benefits over costs.

c. Cost and benefit data for the Department of Agriculture projects and programs were presented in Section VI and are not repeated

here except in the concluding paragraph 49 which summarizes costs and benefits.

48. COSTS

a. Project costs are the value of labor, goods, and services that would be required to implement, operate, and maintain a project. Market prices are assumed to be an adequate measure of the value of the labor, goods, and services.

b. Estimated investment costs involved in economic evaluation of projects include first costs, interest during construction, and the present value of facilities to be added at a future date. Cost estimates for Corps of Engineers projects were based on July 1967 price levels.

c. Annual costs include interest and amortization on the investment costs, annual operation and maintenance costs, and the annual equivalent cost of major replacements. Interest and amortization for Corps of Engineers projects are based on an interest rate of 3-1/4 percent and a project economic life of 100 years. In those instances where the estimated annual net profit from land production was larger than the annual equivalent of the purchase price of lands, the excess was used as an economic cost. This will be referred to as a "loss of production" cost.

49. EVALUATED BENEFITS

a. Types of benefits. The ultimate aim of resource projects and programs, in common with all other productive activity, is to satisfy human needs and desires. Goods and services are produced to achieve this end. These goods and services have value in accordance with the demand for them and their availability. There are two general categories of benefits, primary and secondary. Primary benefits are the increases in the value of goods or services directly resulting from a project, less all associated non-project costs incurred in their realization. Primary benefits are evaluated at the earliest stage for which estimated market prices are considered applicable. Secondary benefits are the increases in net income in activities stemming from or induced by the project. Secondary benefits were not evaluated in connection with Corps of Engineers projects. Area Redevelopment benefits, stemming from wages and salaries generated locally from construction, operation, and maintenance of projects in areas classified as having persistent unemployment or underdevelopment by the Economic Development Administration, were considered only to show how they would improve the economic justification.

b. Evaluation period. Benefits which would accrue to the 10- to 15-year projects have been estimated on the basis of a useful and

economic life of 100 years. Benefits expected to accrue from developments in the area at varying times in the future were reduced to an average annual equivalent value by compound interest methods. Corps of Engineers used an interest rate of 3-1/4 percent.

c. Flood control and prevention.

(1) Flood control and prevention benefits that are expected to result from the main stem and major tributary reservoirs and the upstream impoundments, consist of flood losses that would be prevented on present and future developments and increased utilization benefits.

(2) Flood losses prevented were computed as the difference between losses with the base condition projects functioning and losses with the reservoirs or impoundment projects in the 10- to 15-year plan functioning together with the base condition projects. These losses prevented were based on a system analysis of all the reservoirs and impoundments in the 10- to 15-year plan that have flood control as a purpose. Each of these projects received its proportionate share of system benefits in areas of common influence. System benefits were distributed on the basis of each project being considered in first position in the system.

(3) Increased utilization benefits result from changed or intensified use of the flood plain lands. Because most of the land in the flood plain of the White River and its major tributaries is already cleared and developed, or will be cleared and developed without additional flood protection, no increased utilization benefits have been credited to Corps of Engineers projects.

(4) Adjusted normalized prices were used in estimating flood control and prevention benefits.

d. Drainage. Drainage benefits were estimated on the basis of increased yields on present cropland resulting from removal of wetness hazards and the net income from these yields based on adjusted normalized prices. It was assumed that there would be no increase in allotted or price-supported crop acreage, total crop acreage, or changed land use. The benefits were discounted by 25 percent to allow for expected incomplete participation in the installation of on-farm drainage systems. They were further discounted 20 percent to allow for ineffective maintenance of on-farm drainage systems. The benefits thus obtained were credited to drainage and flood prevention on a 50-50 basis.

e. Municipal and industrial water supply. Municipal and industrial water supply benefits were determined on the basis of the cost

of obtaining water of equal quality and quantity from the cheapest alternative source.

f. Water quality control.

(1) Water quality control benefits for the one Corps of Engineers project, County Line Dam and Reservoir, with storage for this purpose were determined on the basis of the least costly alternative. The least costly alternative for this project was advance waste treatment facilities.

(2) The Department of the Interior has recently altered its policy for computing water quality control benefits. The Secretary has directed the Federal Water Pollution Control Administration and other Interior Agencies to develop benefits based on more direct methods than alternative costs, in instances where it is considered practicable. Guidelines state that new methods should be directed toward specific use of the streams. Benefits would accrue from increased usage of the clean stream as compared to the use of the polluted stream. These benefits were determined for the inclusive use of the streams for recreation and fish and wildlife purposes. The benefits were developed by the Bureau of Outdoor Recreation and the Bureau of Sport Fisheries and Wildlife, in cooperation with the Federal Water Pollution Control Administration and are presented in Appendix N. However, the determination was made in the later part of the study period, after the project formulation studies had been completed. Therefore, the benefits used in the formulation studies were developed by the least-costly alternative method.

g. Hydroelectric power. Hydroelectric power benefits were based on at-site annual capacity and energy values furnished by the Federal Power Commission. These values are based on the alternative costs of producing fuel electric power by means of an investor-owned-and-financed, large, efficient thermal plant and federally financed transmission facilities.

h. Recreation. Recreation benefits were based on the estimated annual use in recreation days expected at each project and an estimated value per recreation day. This value was determined on the basis of the project location with respect to population centers, location of alternative recreation areas, the quality of facilities to be provided at each project, and other factors. The value ranges from $0.50 to $1.25 which is within the range of values presented in Supplement 1 to Senate Document No. 97.

i. Fish and wildlife. Fish and wildlife benefits were based on the annual man days of use expected at each project and an estimated value per day. The estimated number of fisherman days is expected to increase after the initial installation at some projects and remain constant at others. The estimated value per day ranges from $0.50 to $4.00 depending on the type fishery, the lower values being for small

privately controlled impoundments and the higher values for tailwater trout fishery downstream from some of the larger reservoirs. These values are within the range of those presented in Supplement 1 to Senate Document No. 97.

j. Navigation. This report does not include an estimate of the benefits that would accrue from making the lower White River navigable. However, the navigation benefits used in screening studies were the savings to shippers who would use the waterway. These studie indicate that substantial benefits would result from a navigation proj ect on the White River. However, further study, which has been author ized, will be necessary to firmly establish the economics of this feature of the 10- to 15-year plan.

50. SUMMARY OF ECONOMIC DATA

a. Costs, benefits, and benefit-to-cost ratios.

(1) A summary of economic data for Corps of Engineers main stem and major tributary reservoir projects is presented on Table 54. The data on the table includes first cost; annual cost, with loss of production on lands included; average annual benefits, with and without area redevelopment; and benefit-to-cost ratios, with and without area redevelopment.

(2) A summary of economic data for Corps of Engineers levee and channel improvement projects is presented on Table 55. The data on the table include investment cost; annual cost, both Federal and non-Federal; annual cost including loss of production on lands; and annual benefits and benefit-to-cost ratios, both with and without area redevelopment.

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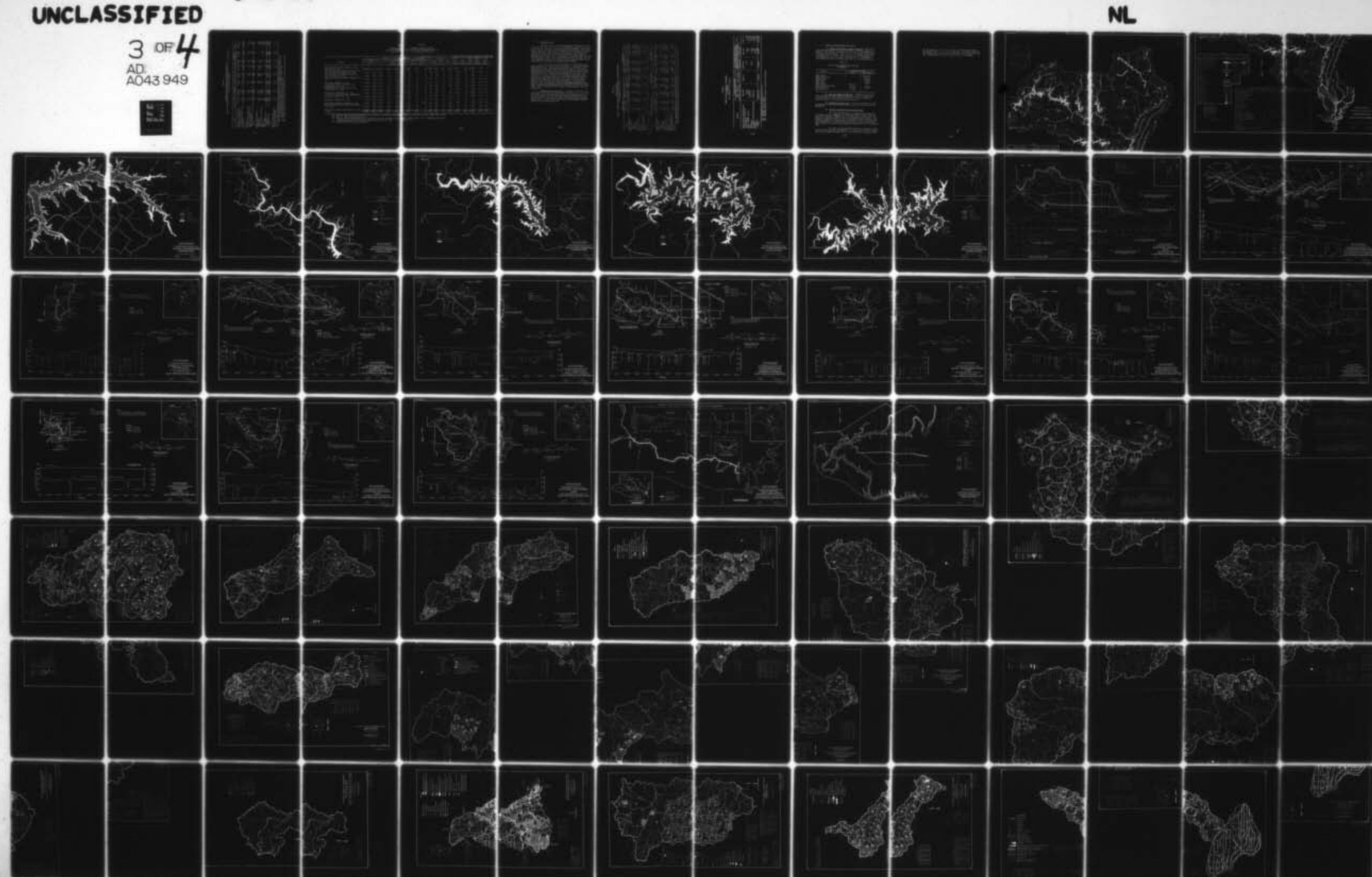

TABLE 54

ESTIMATED COSTS, BENEFITS, AND BENEFIT-TO-COST RATIOS
CORPS OF ENGINEERS MAIN STEM AND MAJOR TRIBUTARY RESERVOIR PROJECTS - 10- TO 15-YEAR PLAN
(In thousands of dollars)

Item	County Line	Wolf Bayou	Myatt Creek	Wild Horse	Bell Foley	Quarry	Norfork Units 3 & 4	Total
First cost of construction:	$15,800	$123,000	$8,480	$18,700	$24,100	$4,200	$12,900	$207,180
Interest during const (1)	770	13,991	414	1,215	1,175	136	600	18,301
Present value of future recreation facilities (2)	167	228	18	98	124	64	-	699
Investment cost	16,737	137,219	8,912	20,013	25,399	4,400	13,500	226,180
Annual cost:								
Interest & amortization (3)	567	4,649	302	678	860	149	458	7,663
Operation & maintenance (4)	117	447	55	108	147	30	80	984
Major replacements	1	116	1	4	6	-	33	161
Loss of production on lands	63	149	22	53	77	13	0	377
Total	748	5,361	380	843	1,090	192	571	9,185
Average annual benefits:								
Flood control	128	2,557	851	1,700	2,355	-	-	7,591
Recreation	1,090	1,830	210	660	1,280	72	-	5,142
Fish & wildlife enhancement	143	278	28	106	151	120	-	826
Power	-	3,852	-	-	-	-	1,411	5,263
Water supply	426	-	-	-	-	-	-	426
Water quality control	282	-	-	-	-	-	-	282
Subtotal	2,069	8,517	1,089	2,466	3,786	192	1,411	19,530
Area redevelopment	67	509	37	81	104	20	41	859
Total	2,136	9,026	1,126	2,547	3,890	212	1,452	20,389
Benefit to-cost ratio:								
Without area redevelopment	2.8	1.6	2.9	2.9	3.5	1.0	2.5	2.1
With area redevelopment	2.9	1.7	3.0	3.0	3.6	1.1	2.5	2.2

(1) Based on 3-1/4 percent of first cost for 1/2 the estimated construction period.
(2) It is estimated that additional facilities to accomodate increased future recreational use will be developed uniformly over the first 20 years of project life.
(3) 100-year economic life and 3-1/4 percent interest rate.
(4) Includes present value of operation and maintenance for future recreational facilities.

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ESTIMATED CO
LEVEE AND CHANNEL
(In thous

Projects	Investment Cost (1) Federal	Non-Federal	Total	Federal Total(3)	Non-Fe Interest & amortization	Op & n
Black River-Cane Creek, Butler Co., Mo., and Clay Co., Ark.	$7,640	$2,7	$10,370	$280	$92	
Little Black River, Butler and Ripley Cos., Mo., and Clay and Randolph Cos., Ark.	2,200	300	2,500	82	10	
Current-Little Black Rivers, Ripley Co., Mo., and Clay Co., Ark.	1,210	220	1,430	46	7	
Black-Current-Fourche Rivers, Randolph Co., Ark.	2,000	480	2,480	78	16	
Flat Creek, Lawrence Co., Ark.	1,020	250	1,270	40	8	
Clover Bend, Lawrence, Jackson, and Independence Cos., Ark.	2,950	1,140	4,090	111	39	
Black-Strawberry Rivers, Lawrence and Independence Cos., Ark.	1,800	420	2,220	66	14	
Curia Creek, Independence Co., Ark.	3,160	230	3,390	114	8	
Oil Trough to Hurricane Lake, Independence, Jackson, and White Cos., Ark.	5,870	1,070	6,940	214	36	
Jacksonport, Jackson Co., Ark.	970	140	1,110	35	5	
Taylor Bay to Augusta, Woodruff Co., Ark.	3,350	250	3,600	119	9	
Little Red-White Rivers, White and Prairie Cos., Ark.	4,370	660	5,030	159	22	
Bayou Des Arc, White and Prairie Cos., Ark.	2,890	400	3,290	98	13	
Total	39,430	8,290	47,720	1,442	279	

(1) Includes interest during construction on projects with estimated constructi
(2) Based on total annual economic cost.
(3) Includes interest and amortization of investment cost and estimated annual
authorized by Public Law 99, 84th Congress, approved 28 June 1955.
(4) Includes $2,500 for major replacement.

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TABLE 55

ESTIMATED COSTS AND BENEFITS
LEVEE AND CHANNEL IMPROVEMENT PROJECTS
(In thousands of dollars)

Annual Cost							Average Annual Benefits			Benefit-Cost Ratio (2)	
Federal	Non-Federal										
Total(3)	Interest & amortization	Operation & maintenance	Total	Total financial	Loss of production on lands	Total Economic	Without area redevelopment	Area redevelopment	With area redevelopment	Without area redevelopment	With area redevelopment
$280	$92	$6	$98	$378	$15	$393	$1,746	$0	$1,746	4.4	-
82	10	2	12	94	5	99	725	10	735	7.3	7.4
46	7	2	9	55	3	58	444	5	449	7.7	7.8
78	16	3	19	97	9	106	1,300	9	1,309	12.2	12.3
40	8	2	10	50	2	52	470	6	476	9.0	9.2
111	39	6	45	156	6	162	1,390	15	1,405	8.6	8.7
66	14	2	16	82	5	87	583	9	592	6.7	6.8
114	8	2	10	124	4	128	1,680	13	1,693	13.1	13.2
214	36	7	43	257	14	271	400	22	422	1.5	1.6
35	5	2	7	42	1	43	47	4	51	1.1	1.2
119	9	(4)14	23	142	2	144	608	11	619	4.2	4.3
159	22	3	25	184	11	195	710	20	730	3.6	3.7
98	13	4	17	115	0	115	124	17	141	1.1	1.2
1,442	279	55	334	1,776	77	1,853	10,227	141	10,368	5.5	5.6

estimated construction periods longer than 2 years.

and estimated annual cost of emergency levee repair
28 June 1955.

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b. Allocated costs.

(1) The cost of the multiple-purpose reservoirs in the 10- to 15-year plan has been allocated to the purposes applicable to each project by the Separable Cost-Remaining Benefits Methods. This method assures that each purpose shares equitably in the savings of multiple-purpose development and meets the criteria that costs allocated to any purpose do not exceed corresponding benefits; each purpose is assigned its separable cost as a minimum; and separable costs are less than alternative costs. The average annual cost and benefits used for cost allocation purposes are exclusive of the economic values of loss of production on land and area redevelopment benefits.

(2) The least costly alternative for flood control and water supply was an at-site reservoir project. A federally financed steam-electric power development was found to be the least costly alternative for two additional hydroelectric units at the existing Norfork multiple-purpose project and the hydroelectric units in the Wolf Bayou project. Advance waste treatment was the least costly alternative for water quality control storage at the County Line project. An alternative project to serve both recreation and fish and wildlife enhancement was used in the cost allocation studies instead of a separate project for each purpose. Cost allocation data for Corps of Engineers reservoir projects are presented in Table 56. The cost allocation data are preliminary and were determined to show the general magnitude of the cost of each project purpose. Cost allocations will be reviewed and brought up to date as appropriate.

c. Summary of allocated costs. A summary of the allocated first cost of the Corps of Engineers projects and the Soil Conservation Service upstream watershed projects is presented in Table 57. The costs shown are for the additional projects formulated in connection with the comprehensive studies and included in the comprehensive plan. It does not include cost of land treatment measures which were covered in Section VI.

TABLE 56

COST ALLOCATION
CORPS OF ENGINEERS MAIN STEM AND MAJOR TRIBUTARY RESERVOIR PROJECTS
(In thousands of dollars)

Item	County Line: Flood Control	County Line: Water Supply	County Line: Recreation: Fish and Wildlife	County Line: Water Quality Control	County Line: Total	Wolf Bayou: Flood Control	Wolf Bayou: Recreation: Fish and Wildlife	Wolf Bayou: Power	Wolf Bayou: Total
Annual benefits	128	426	1,233	282	2,069	2,557	2,108	3,852	8,517
Annual cost:									
Total	76	181	306	122	685	1,561	1,458	2,193	5,212
Separable	42	18	105	15	180	1,077	277	1,959	3,313
Alternative	443	426	607	282	1,758	1,828	2,171	2,322	6,321
First cost (1)	1,435	4,672	6,764	3,096	15,967	39,063	32,515	51,650	123,228
Investment cost (2)	1,505	4,900	7,085	3,247	16,737	43,506	36,187	57,526	137,219
Percent	9.0	29.1	42.7	19.2	100.0	31.7	26.4	41.9	100.0
Operation, maintenance, and replacement cost	25	15	66	12	118	87	232	244	563
Percent	21.2	12.7	55.9	10.2	100.0	15.5	41.2	43.3	100.0

Item	Myatt Creek: Flood Control	Myatt Creek: Recreation: Fish and Wildlife	Myatt Creek: Total	Wild Horse: Flood Control	Wild Horse: Recreation: Fish and Wildlife	Wild Horse: Total	Bell Foley: Flood Control	Bell Foley: Recreation: Fish and Wildlife	Bell Foley: Total
Annual benefits	851	238	1,089	1,700	766	2,466	2,355	1,431	3,786
Annual cost:									
Total	197	161	358	398	392	790	444	569	1,013
Separable	80	66	146	226	220	446	157	283	440
Alternative	292	278	570	570	564	1,134	730	856	1,586
First cost (1)	4,868	3,630	8,498	9,784	9,014	18,798	10,814	13,410	24,224
Investment cost (2)	5,105	3,807	8,912	10,420	9,593	20,013	11,341	14,058	25,399
Percent	57.3	42.7	100.0	52.1	47.9	100.0	44.7	55.3	100.0
Operation, maintenance, and replacement cost	24	32	56	45	67	112	60	93	153
Percent	42.9	57.1	100.0	39.8	60.2	100.0	39.2	60.8	100.0

(1) Includes present value of future recreation facilities.
(2) Includes interest during construction and present value of future recreation facilities.

TABLE 57

FIRST COST OF PROJECTS & PROGRAMS
BY PURPOSES
(In thousands of dollars)

Purpose	Corps of Engineers		Soil Conservation Service		Total
	Main stem and major tributary dams and reservoirs	Local protection projects	Upstream watershed projects: Single-purpose structures	Upstream watershed projects: Multiple-purpose structures	
Flood control and prevention	$65,964	$46,530	$122,546	$52,172	$287,212
Municipal and industrial water supply	4,672		373	1,051	6,096
Water quality control	3,096			998	4,094
Power	(1)64,550				64,550
Recreation			6,762	5,089	11,851
Recreation and fish and wildlife	(2)69,597			703	70,300
Drainage				35,941	35,941
Irrigation				525	525
Total	(3)207,879	46,530	129,681	96,479	480,569

(1) Includes cost of Norfork units 3 & 4.
(2) Includes cost of Quarry.
(3) Includes present value of future recreation facilities.

d. Costs of other programs and studies.

(1) Stream preservation program in Missouri. The cost of the stream preservation program in the State of Missouri is given in Table 58. The Federal costs shown are for portions of streams within National Forest boundaries. The cost of these programs in the State of Arkansas and the private sector programs has not been estimated. As stated previously, the primary responsibility for development of such measures is with the States, municipalities, and private sector.

TABLE 58

COST OF STREAM PRESERVATION PROGRAMS
IN MISSOURI

Project	Installation cost	
	Federal	Non-Federal
James River		$211,200
Upper Black River		253,500
Bryant Creek		271,500
Bull Creek		76,800
Swan Creek		99,450
Beaver Creek	$590,000	
Little North Fork River	320,000	70,000
North Fork River	480,000	59,050
Roaring River	80,000	

(2) National Forest acquisition. Acquisition of 373,000 acres of additional land within the National Forests is estimated to cost $37,300,000. This includes the $1,470,000 shown in Table 58 above as a part of the cost of stream preservation.

(3) National recreation area. The total estimated cost for the additional facilities required for the national recreation area is $5,894,000.

(4) Studies on navigation and pumped-storage.

(a) Costs and benefits for a pumped-storage hydroelectric project at the Optimus site and navigation on the White River from the mouth to Newport, Arkansas, were not determined for this report because of insufficient funds to make the required detailed analysis. Preliminary evaluations of both projects indicated a need for them and probable justification. For this reason, and also as a basis for planning other features of the basin plan, they were included in the 10- to 15-year plan.

(b) Both of these projects will require separate studies to verify their economic justification. A resolution of the U. S. Senate Public Works Committee adopted May 25, 1967, authorized a separate study

for the lower White River from its mouth to Batesville, Arkansas. The estimated cost of the study is $250,000. No separate study for the pumped-storage hydroelectric project has been authorized at this time. A preliminary estimate of the study cost is $200,000.

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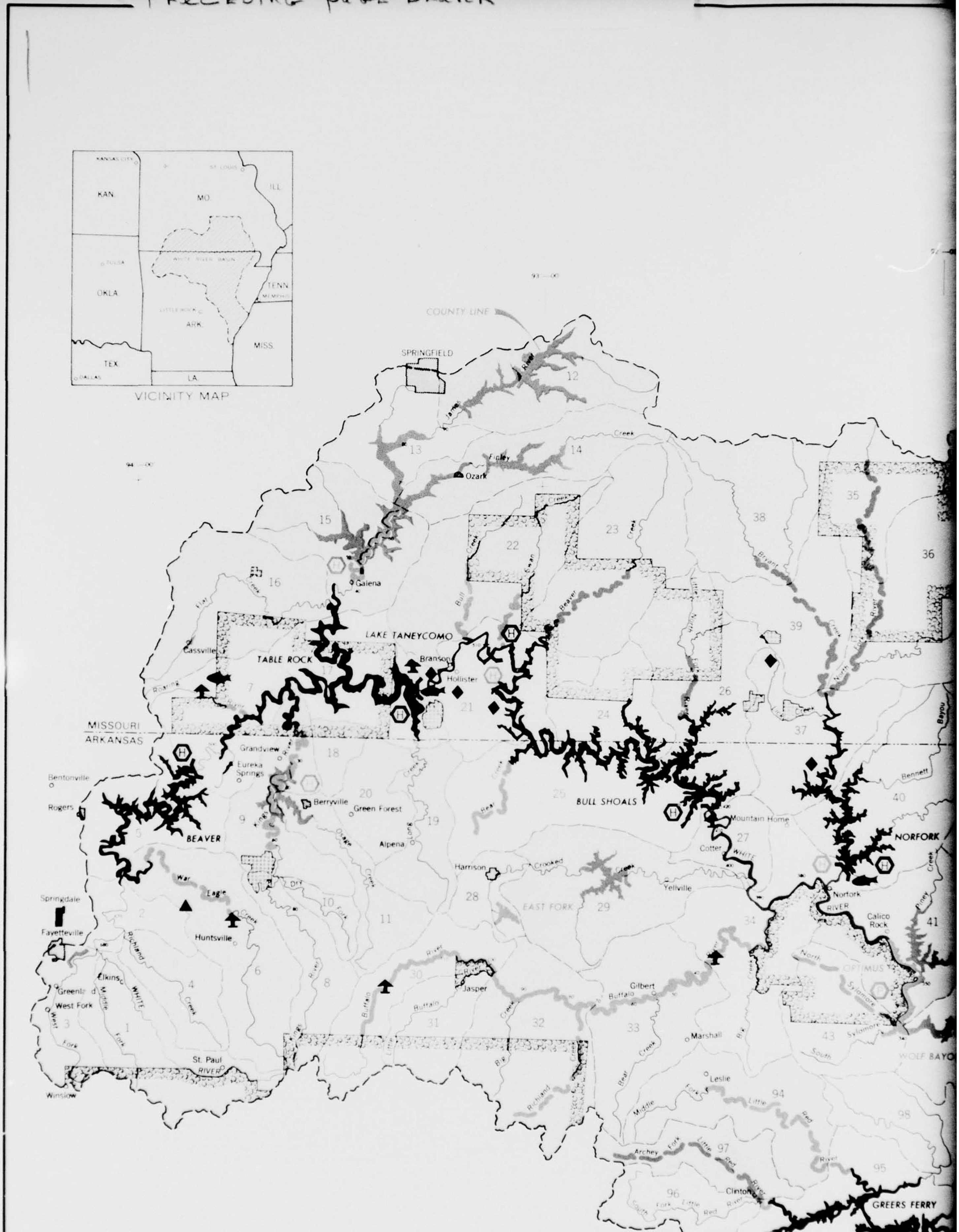
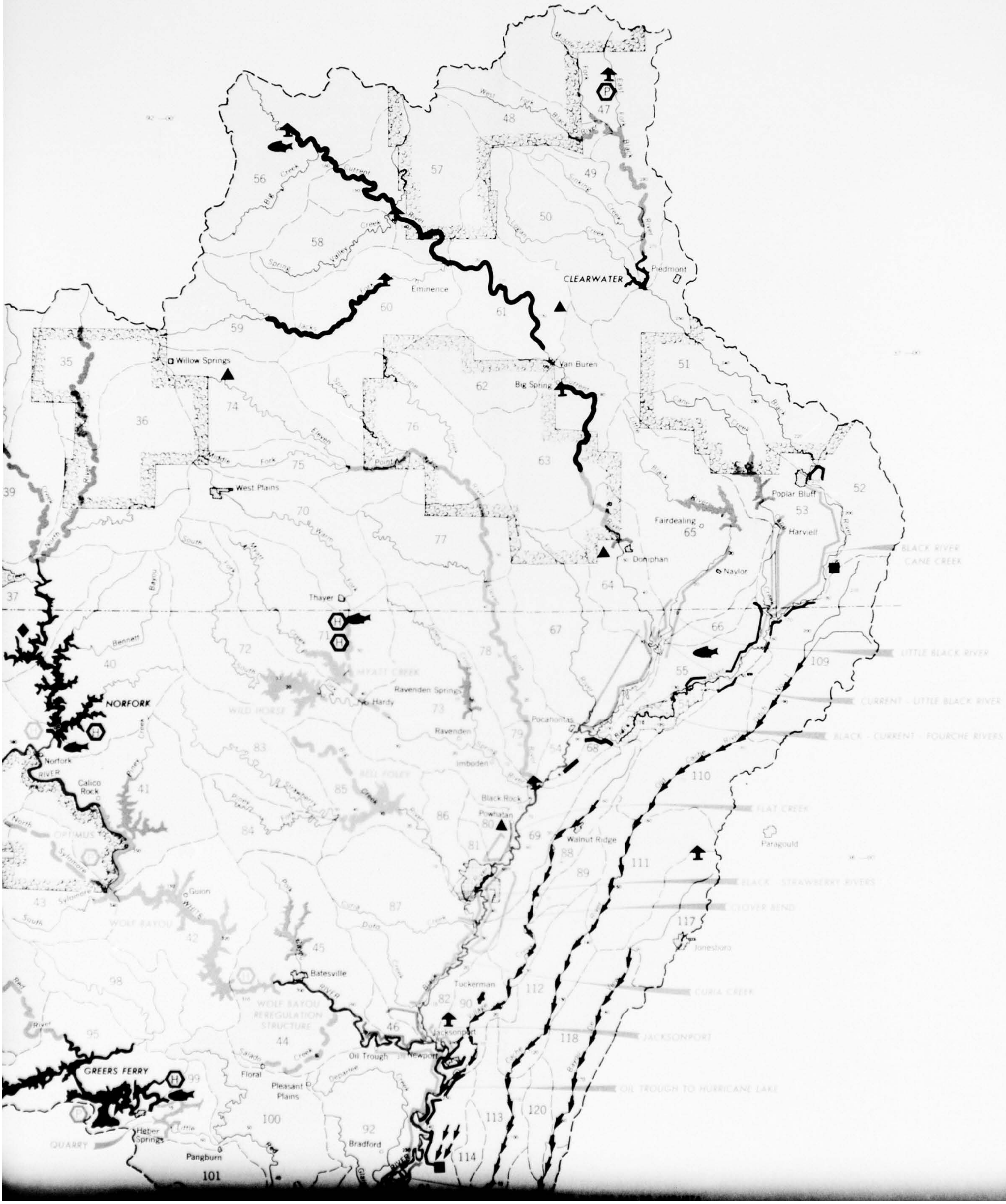


LEGEND

PROJECT OR PROGRAM	EXISTING OR AUTHORIZED	10-15 YEAR	LONG RANGE
Upstream flood prevention program (1)			

2

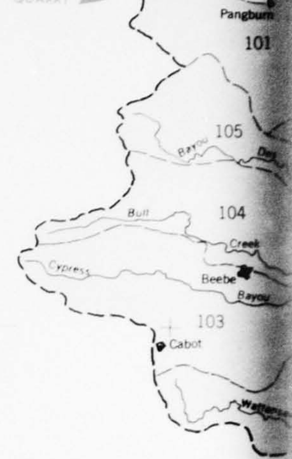

CLEARWATER
Piedmont
Eminence
Van Buren
Big Spring
Willow Springs
West Plains
Poplar Bluff
Harviell
Fairdealing
Doniphan
Naylor
Thayer
Ravenden Springs
Hardy
Ravenden
Imboden
Pocahontas
Black Rock
Powhatan
Walnut Ridge
Paragould
Jonesboro
NORFORK
Norfork
Calico Rock
Guion
Batesville
Tuckerman
Jacksonport
Newport
Oil Trough
Floral
Pleasant Plains
GREERS FERRY
Heber Springs
Pangburn
Bradford
QUARRY
WOLF BAYOU
WOLF BAYOU REREGULATION STRUCTURE
OPTIMUS
WILD HORSE
MYATT CREEK
BELL FOLEY
BLACK RIVER CANE CREEK
LITTLE BLACK RIVER
CURRENT - LITTLE BLACK RIVER
BLACK - CURRENT - FOURCHE RIVERS
FLAT CREEK
BLACK - STRAWBERRY RIVERS
CLOVER BEND
CURIA CREEK
JACKSONPORT
OIL TROUGH TO HURRICANE LAKE
35 36 37 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 92 95 98 99 100 101 109 110 111 112 113 114 117 118 120

3

LEGEND

PROJECT OR PROGRAM	EXISTING OR AUTHORIZED	10-15 YEAR	LONG RANGE
Upstream flood prevention program (1)			
Main stem or major tributary reservoir			
Conventional hydroelectric power	H	H	H
Pumped storage hydroelectric power	P	(2) P	P
Channel improvement			
Levee			
Pumping station			
Navigation		(2)	
National scenic riverway			
Stream preservation			
Irrigation facilities			
National Forest			
National Wildlife Refuge			
State hunting area			
State Wildlife Refuge			
State park			
State fishing lake			
Federal or State fish hatchery			

N



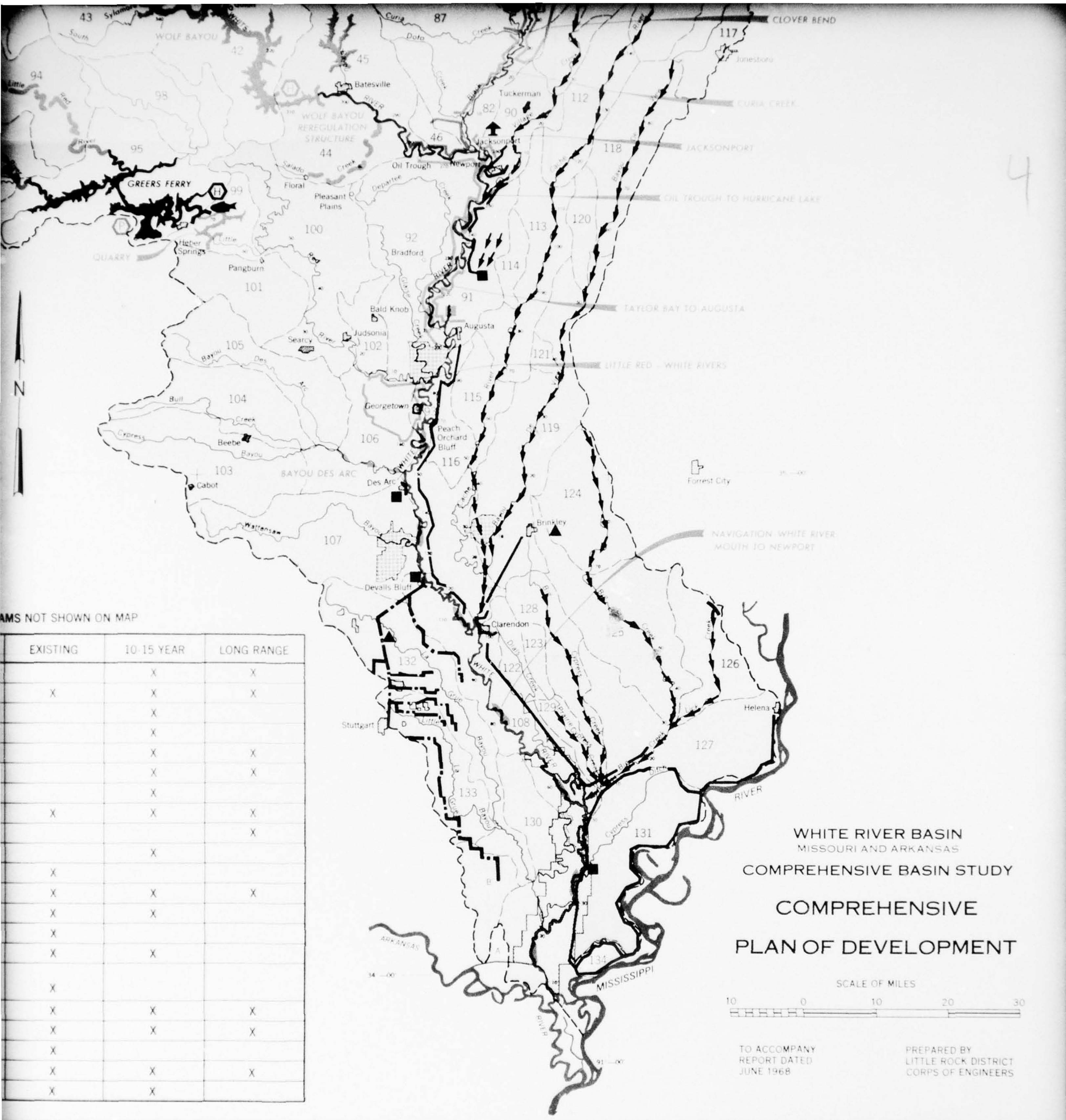
(1) Watershed protection measures have been planned or installed on existing and authorized watersheds. Measures planned for installation on all remaining watersheds are included in the 10-15 year plan.

(2) Subject to further studies

Watershed area and No. 1

PROJECTS OR PROGRAMS NOT SHOWN ON MAP

PROJECT OR PROGRAM	EXISTING	10-15 YEAR	LONG RAN
National Forest land acquisition		X	X
National Forest development program	X	X	X
National Wildlife Refuge lands		X	
National Recreation Area		X	
State hunting and wildlife management areas		X	X
State fishing lakes		X	X
Fish hatchery		X	
Stream access systems	X	X	X
Stream preservation			X
Ozark scenic railway		X	
City parks	X		
Small municipal impoundments	X	X	X
Private fuel-electric power plants	X	X	
Private levees and channel improvements	X		
Private irrigation structures and facilities	X	X	
Private water related recreation, hunting, and fishing facilities	X		
Fish farming	X	X	X
Farm ponds	X	X	X
Natural lakes	X		
Archeologic historic, and scenic points of interest	X	X	X
Hydrologic network	X	X	



AMS NOT SHOWN ON MAP

EXISTING	10-15 YEAR	LONG RANGE
	X	X
X	X	X
	X	
	X	
	X	X
	X	X
	X	
X	X	X
		X
	X	
X		
X	X	X
X	X	
X		
X	X	
X		
X	X	X
X	X	X
X		
X	X	X
X	X	

WHITE RIVER BASIN
MISSOURI AND ARKANSAS
COMPREHENSIVE BASIN STUDY

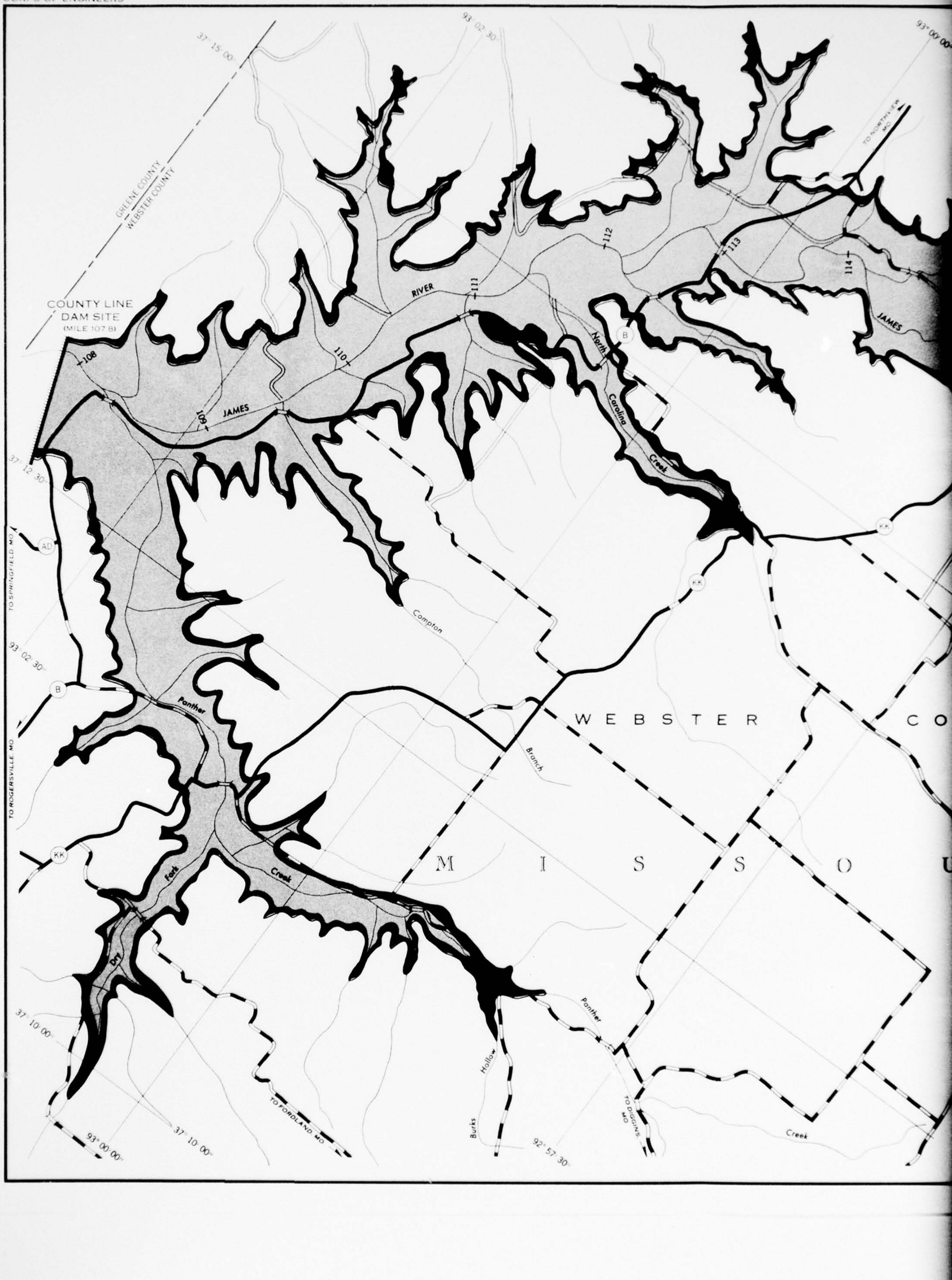
COMPREHENSIVE PLAN OF DEVELOPMENT

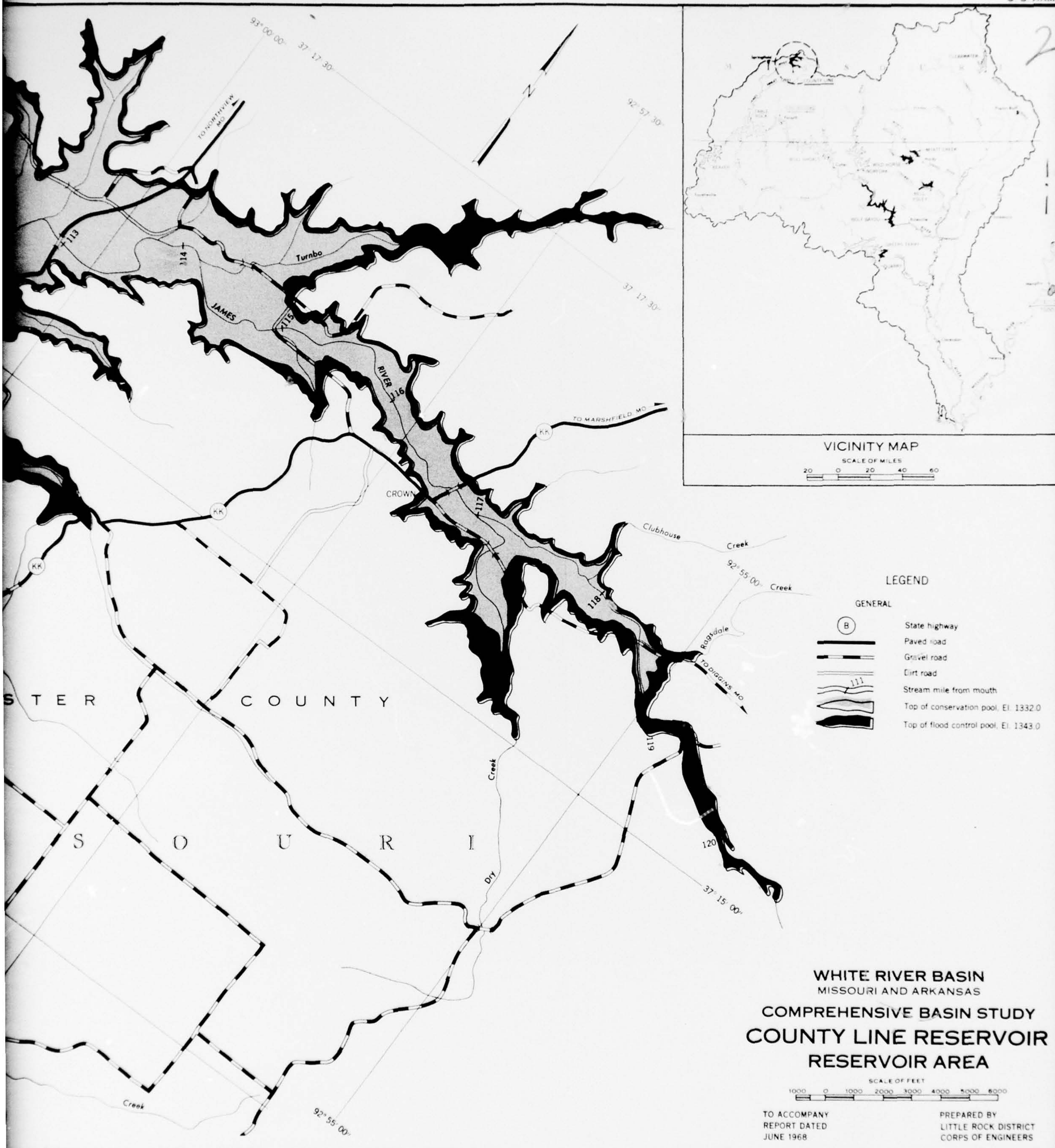
SCALE OF MILES
10 0 10 20 30

TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS

PLATE P-1


COUNTY LINE
DAM SITE
(MILE 107.8)
GREENE COUNTY
WEBSTER COUNTY
37° 15' 00"
93° 02' 30"
93° 00' 00"
TO NORTHVIEW MO
JAMES
RIVER
108
109
110
111
112
113
114
North
Carolina
Creek
Compton
37° 12' 30"
TO SPRINGFIELD MO
AD
93° 02' 30"
B
KK
TO ROGERSVILLE MO
Panther
Fork
Creek
Dry
Branch
WEBSTER
CO
M I S S O U
37° 10' 00"
93° 00' 00"
37° 10' 00"
TO FORDLAND MO
Burks
Hollow
Panther
TO DIGGINS MO
92° 57' 30"
Creek

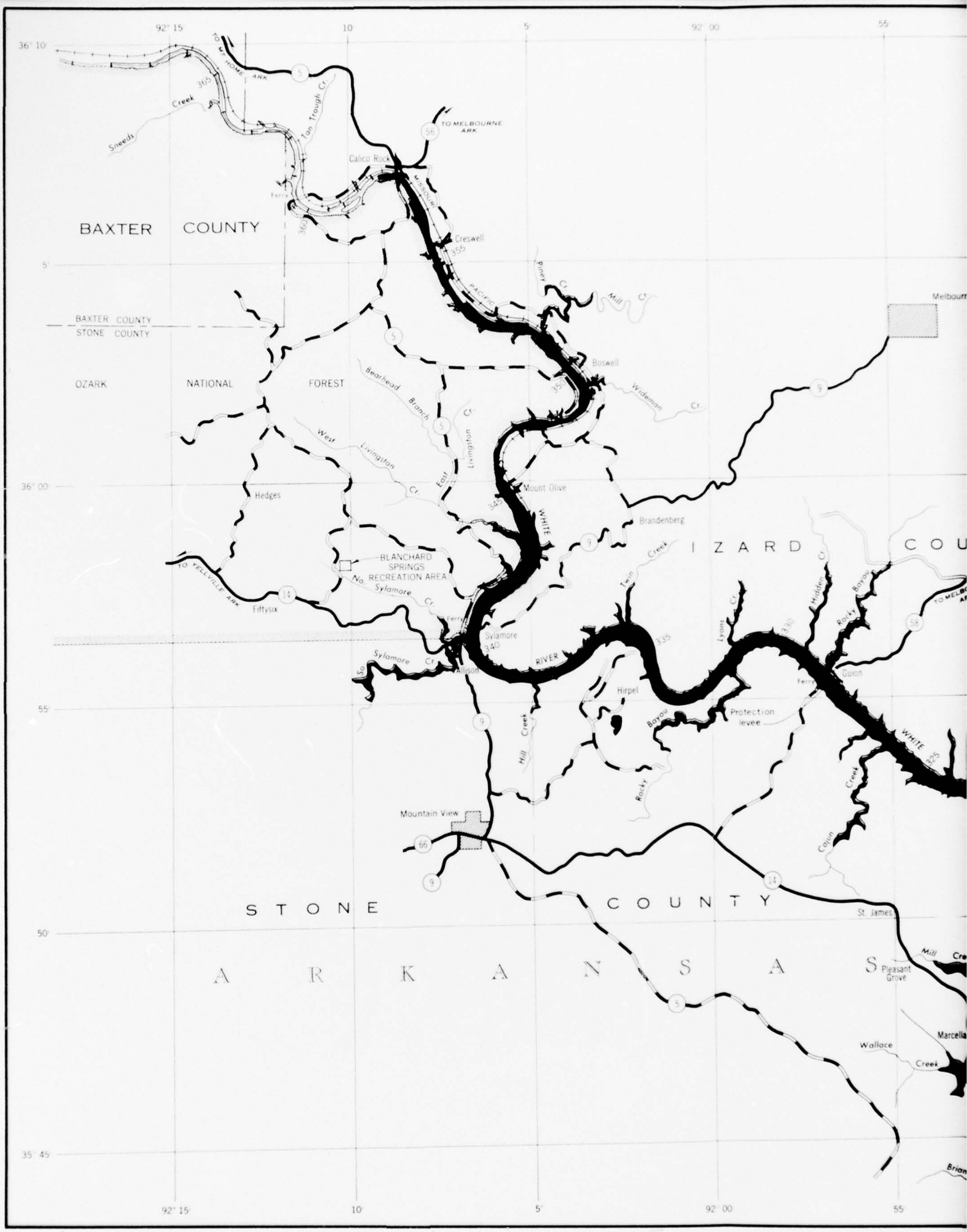


WHITE RIVER BASIN
MISSOURI AND ARKANSAS
COMPREHENSIVE BASIN STUDY
COUNTY LINE RESERVOIR
RESERVOIR AREA

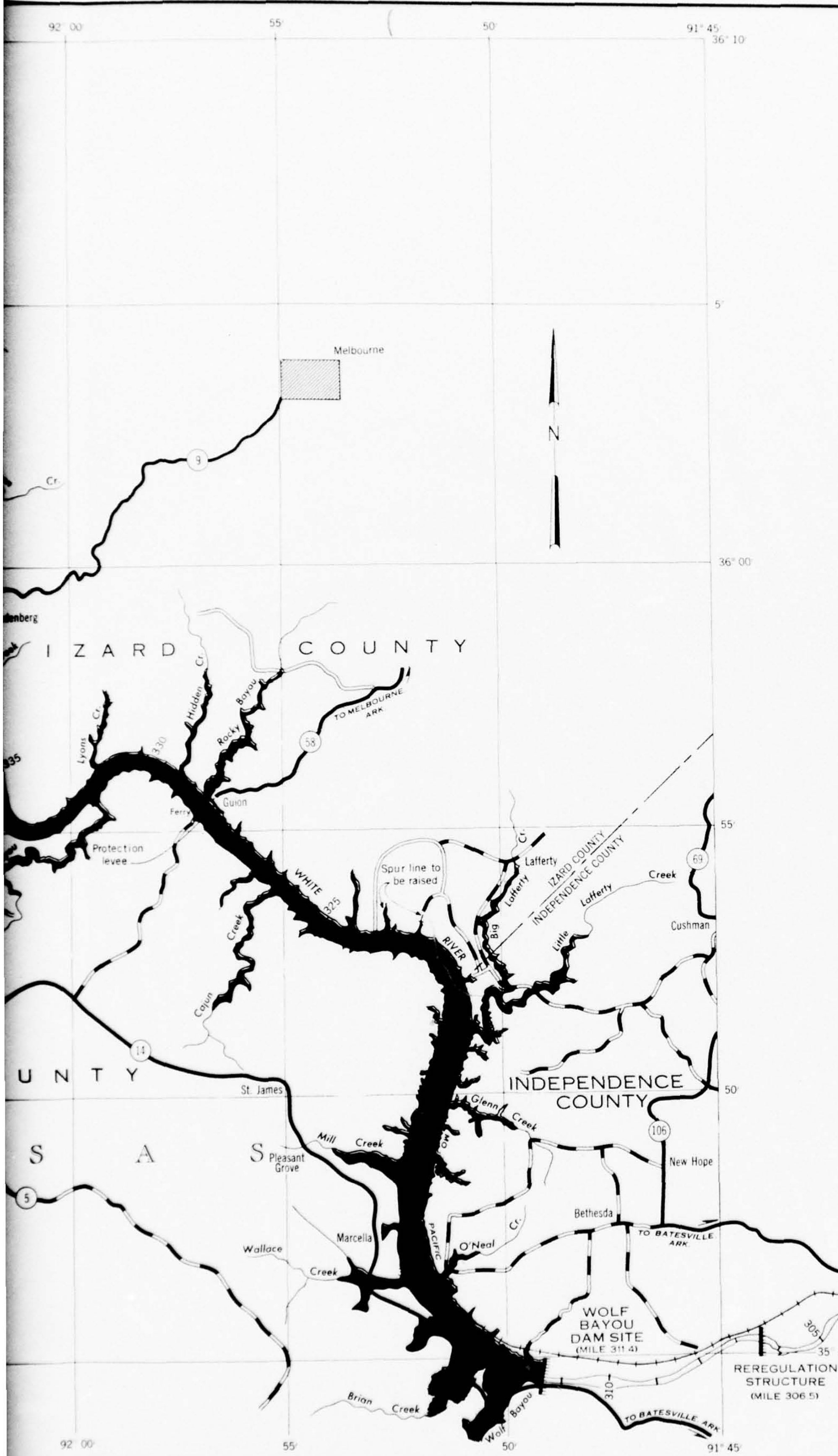
SCALE OF FEET
1000 0 1000 2000 3000 4000 5000 6000

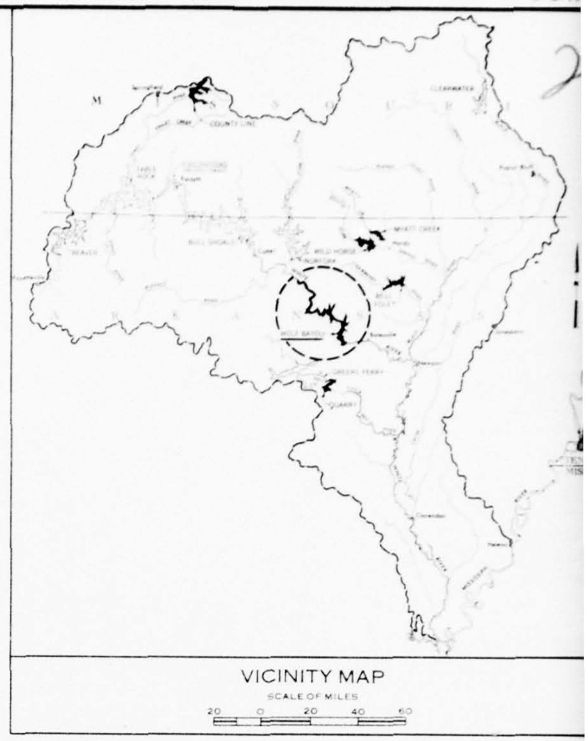
TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS



92° 15'
10'
5'
92° 00'
55'
36° 10'
5'
36° 00'
55'
50'
35° 45'
TO MT HOME ARK
TO MELBOURNE ARK
Calico Rock
Sneeds Creek
Tan Trough Cr.
Ferry
BAXTER COUNTY
MISSOURI
PACIFIC
Creswell
355
365
360
Piney Cr.
Mill Cr.
Melbourne
BAXTER COUNTY
STONE COUNTY
Boswell
350
Wideman Cr.
OZARK NATIONAL FOREST
Bearhead Branch
West Livingston Cr.
East Livingston Cr.
Mount Olive
345
WHITE
Hedges
Brandenberg
IZARD COU
BLANCHARD SPRINGS RECREATION AREA
No. Sylamore Cr.
TO YELLVILLE ARK
Fiftysix
Twin Creek
Hidden Cr.
Rocky Bayou
Lyons Cr.
TO MELBOURNE ARK
Sylamore
340
335
330
So. Sylamore Cr.
Allison
RIVER
Hirpel
Guion
Protection levee
Bayou
Hill Creek
Rocky
WHITE
325
Mountain View
Cajun Creek
STONE COUNTY
St. James
Mill Cre
ARKANSAS
Pleasant Grove
Marcella
Wallace Creek
Brian
5
56
9
14
66





LEGEND

GENERAL

14	State highway
	Paved road
	Gravel road
	Dirt road
	Railroad
15	Stream mile from mouth
	Top of flood control pool, El. 340.0

NOTE:

Top of conservation pool, El. 320.0

WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

WOLF BAYOU RESERVOIR

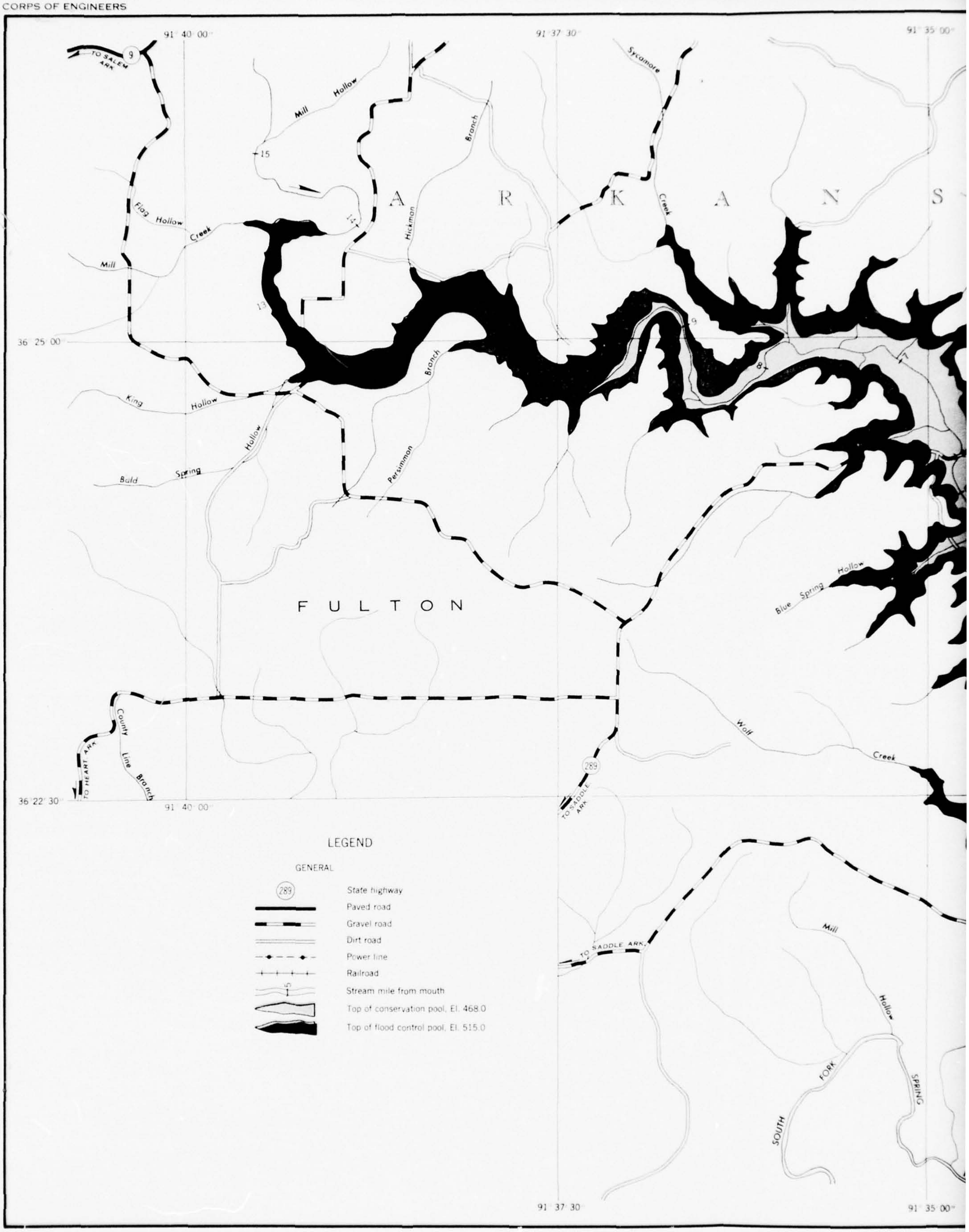
RESERVOIR AREA

SCALE OF MILES

1 0 1 2 3 4 5

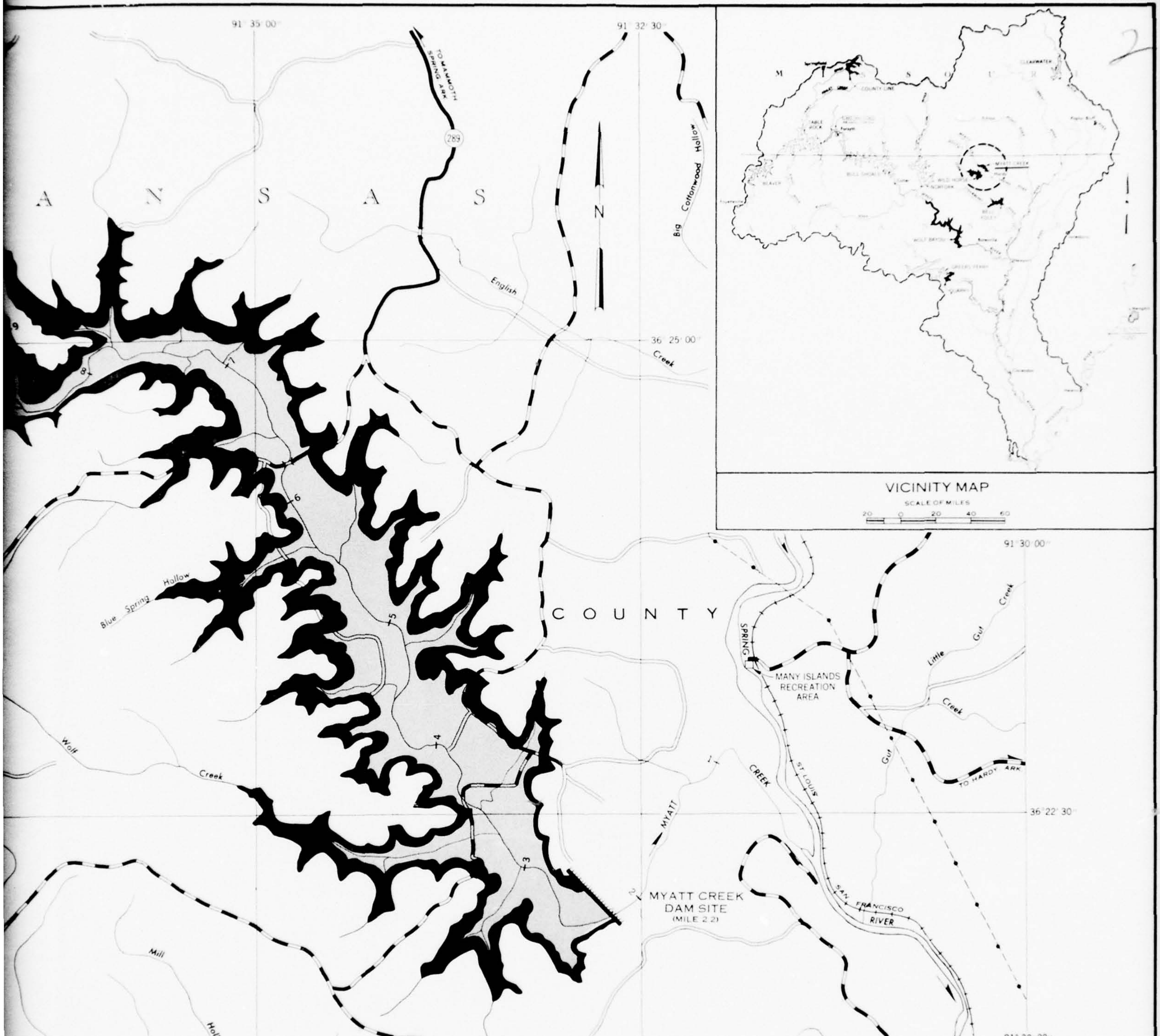
TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS



91°40'00"
91°37'30"
91°35'00"
36°25'00"
36°22'30"
TO SALEM ARK
9
Sycamore
Mill Hollow
Branch
15
14
13
A R K A N S
Creek
Flag Hollow Creek
Mill
Hickmon
9
8
7
King Hollow
Branch
Hollow
Bald Spring
Persimmon
F U L T O N
Blue Spring Hollow
County Line Branch
TO HEART ARK
Wolf Creek
289
TO SADDLE ARK
TO SADDLE ARK
Mill Hollow
SOUTH FORK SPRING
LEGEND
GENERAL
289 State highway
Paved road
Gravel road
Dirt road
Power line
Railroad
Stream mile from mouth
Top of conservation pool, El. 468.0
Top of flood control pool, El. 515.0

U.S. ARMY



WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

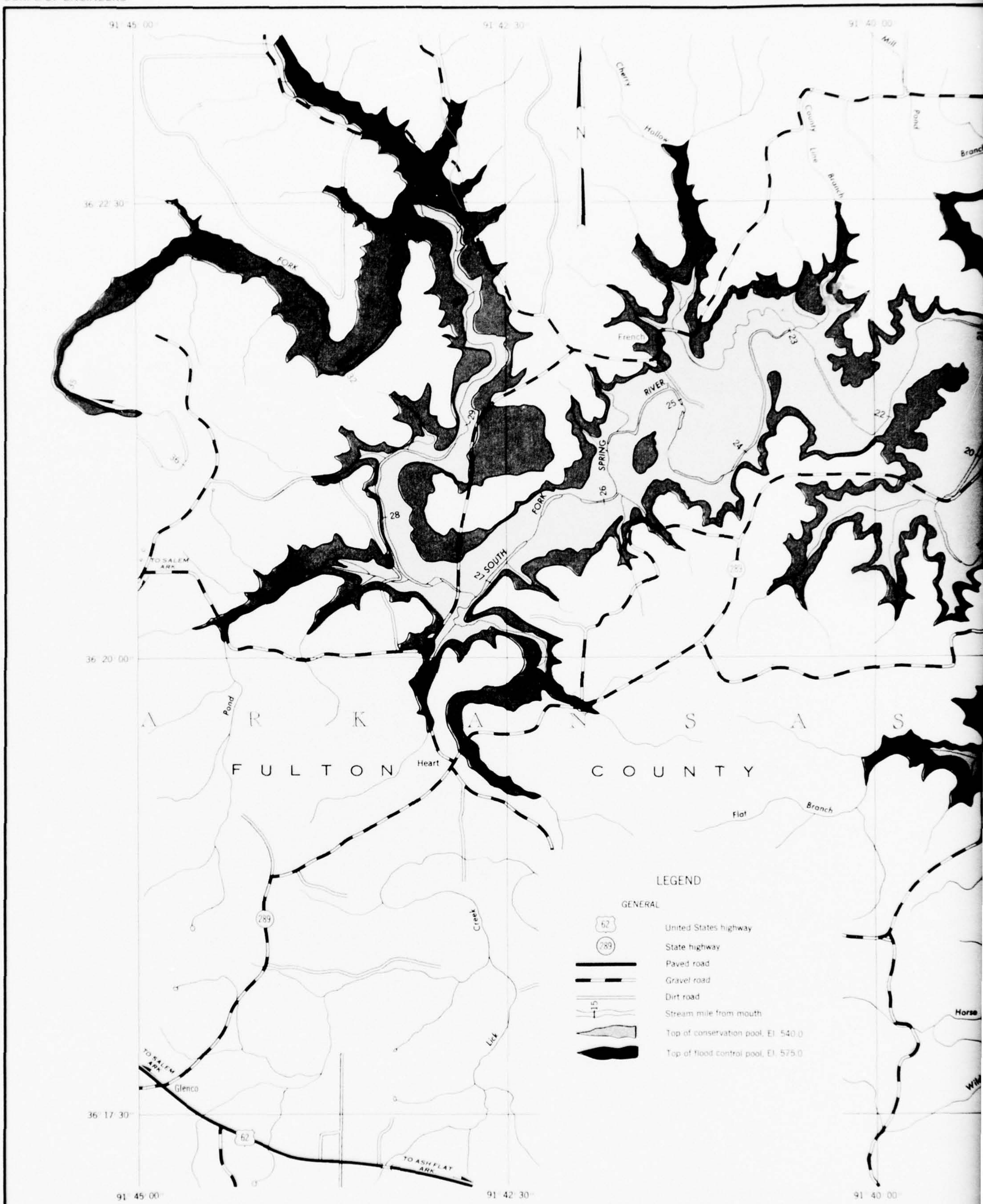
MYATT CREEK RESERVOIR
RESERVOIR AREA

SCALE OF FEET
1000 0 1000 2000 3000 4000 5000 6000

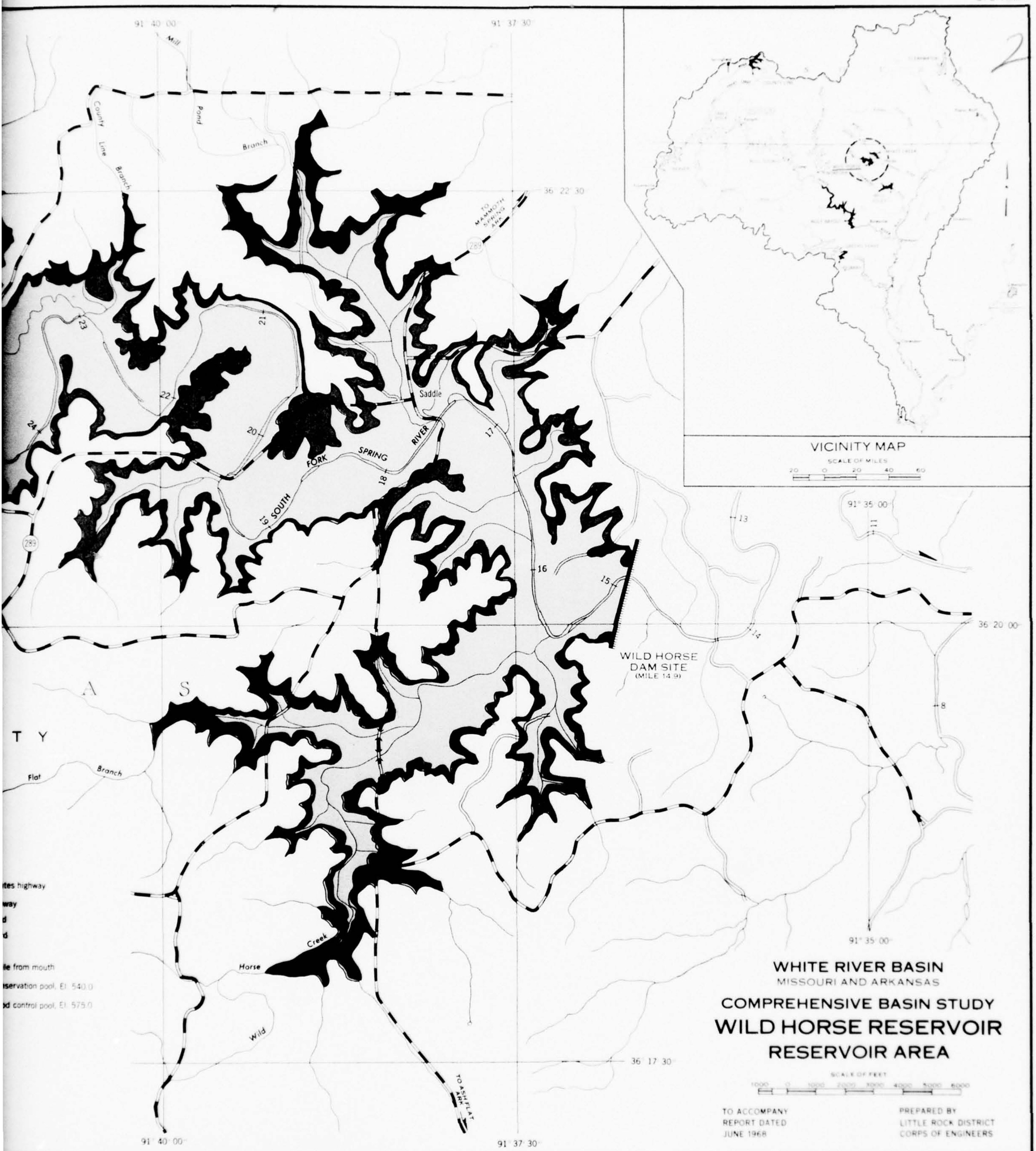
TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS

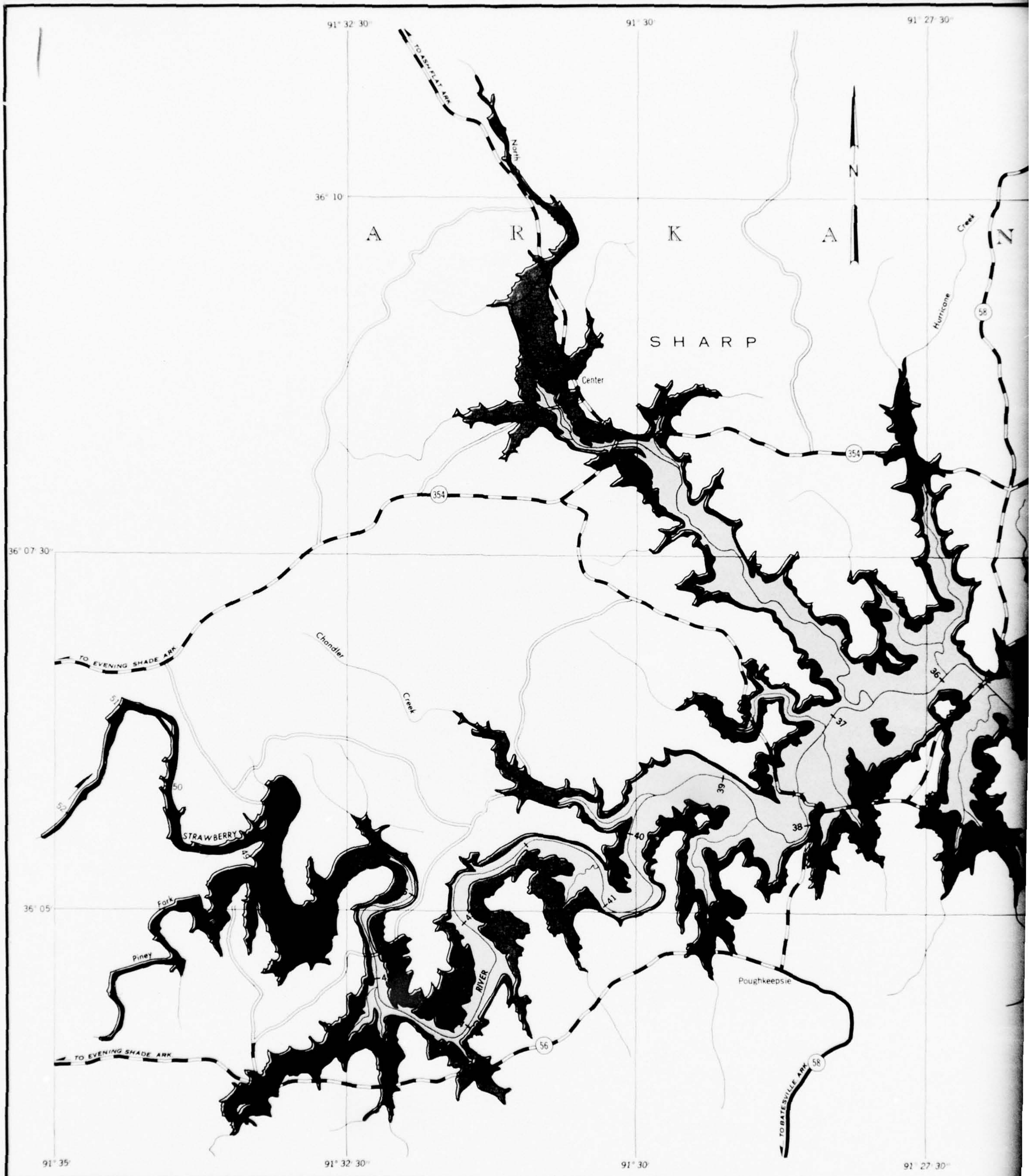
PLATE P-4

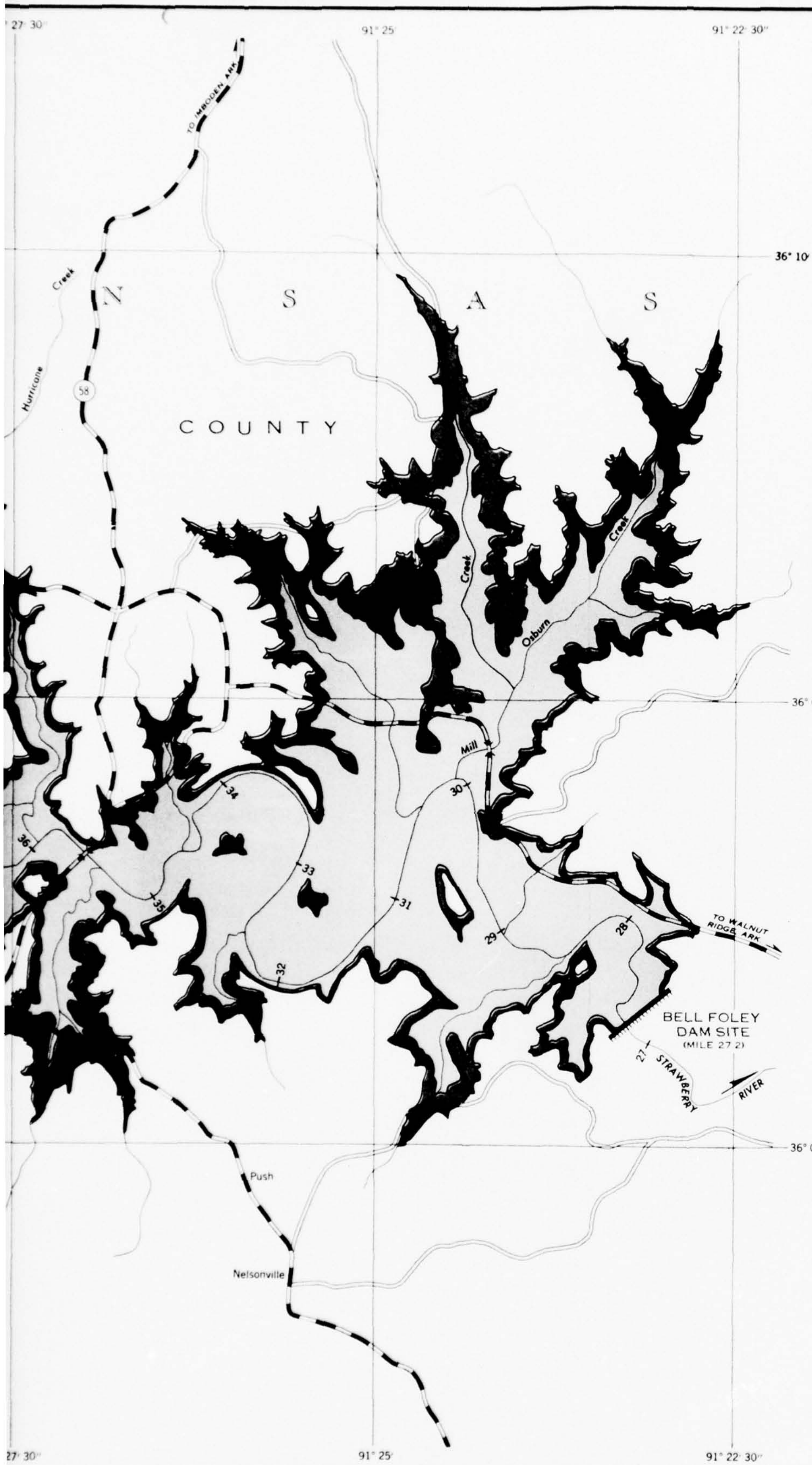


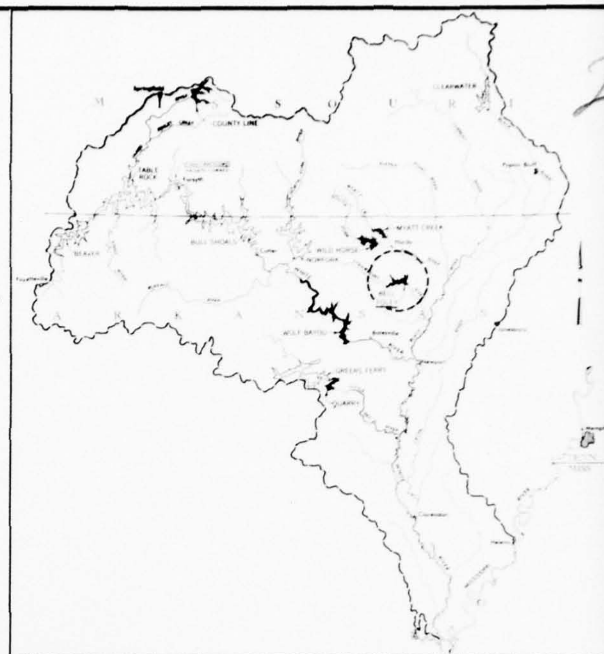
91°45'00"
91°42'30"
91°40'00"
36°22'30"
36°20'00"
36°17'30"
N
Cherry
Hollow
Mill
Pond
Branch
County
Line
Branch
FORK
French
RIVER
SPRING
FORK
SOUTH
29
28
26
25
24
23
22
20
TO SALEM ARK
289
A R K A N S A S
Pond
FULTON
Heart
COUNTY
Flat
Branch
Creek
Lick
Horse
TO SALEM ARK
Glenco
62
TO ASH FLAT ARK
LEGEND
GENERAL
62
United States highway
289
State highway
Paved road
Gravel road
Dirt road
15
Stream mile from mouth
Top of conservation pool, El. 540.0
Top of flood control pool, El. 575.0



91°40'00"
91°37'30"
91°35'00"
36°22'30"
36°20'00"
36°17'30"
Mill
Pond
Branch
County Line Branch
TO MAMMOTH SPRING ARK
289
Saddle
SOUTH FORK SPRING RIVER
13
14
15
16
17
18
19
20
21
22
23
24
WILD HORSE DAM SITE
(MILE 14.9)
A
S
T Y
Flat
Branch
Horse
Creek
Wild
TO ASH FLAT ARK
tes highway
way
ile from mouth
servation pool, El. 540.0
od control pool, El. 575.0
VICINITY MAP
SCALE OF MILES
20 0 20 40 60
WHITE RIVER BASIN
MISSOURI AND ARKANSAS
COMPREHENSIVE BASIN STUDY
WILD HORSE RESERVOIR
RESERVOIR AREA
SCALE OF FEET
1000 0 1000 2000 3000 4000 5000 6000
TO ACCOMPANY
REPORT DATED
JUNE 1968
PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS


91° 32' 30"
91° 30'
91° 27' 30"
TO ASH FLAT ARK
North
N
36° 10'
A
R
K
A
N
Creek
SHARP
Hurricane
58
Center
354
354
36° 07' 30"
36
TO EVENING SHADE ARK
Chandler
Creek
37
51
50
39
52
STRAWBERRY
38
40
36° 05'
Fork
41
Piney
RIVER
Poughkeepsie
56
TO EVENING SHADE ARK
58
TO BATESVILLE ARK
91° 35'
91° 32' 30"
91° 30'
91° 27' 30"





VICINITY MAP

SCALE OF MILES

20 0 20 40 60

LEGEND

GENERAL

354	State highway
	Paved road
	Gravel road
	Dirt road
31	Stream mile from mouth
	Top of conservation pool, El. 356.0
	Top of flood control pool, El. 390.0

WHITE RIVER BASIN

MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

BELL FOLEY RESERVOIR

RESERVOIR AREA

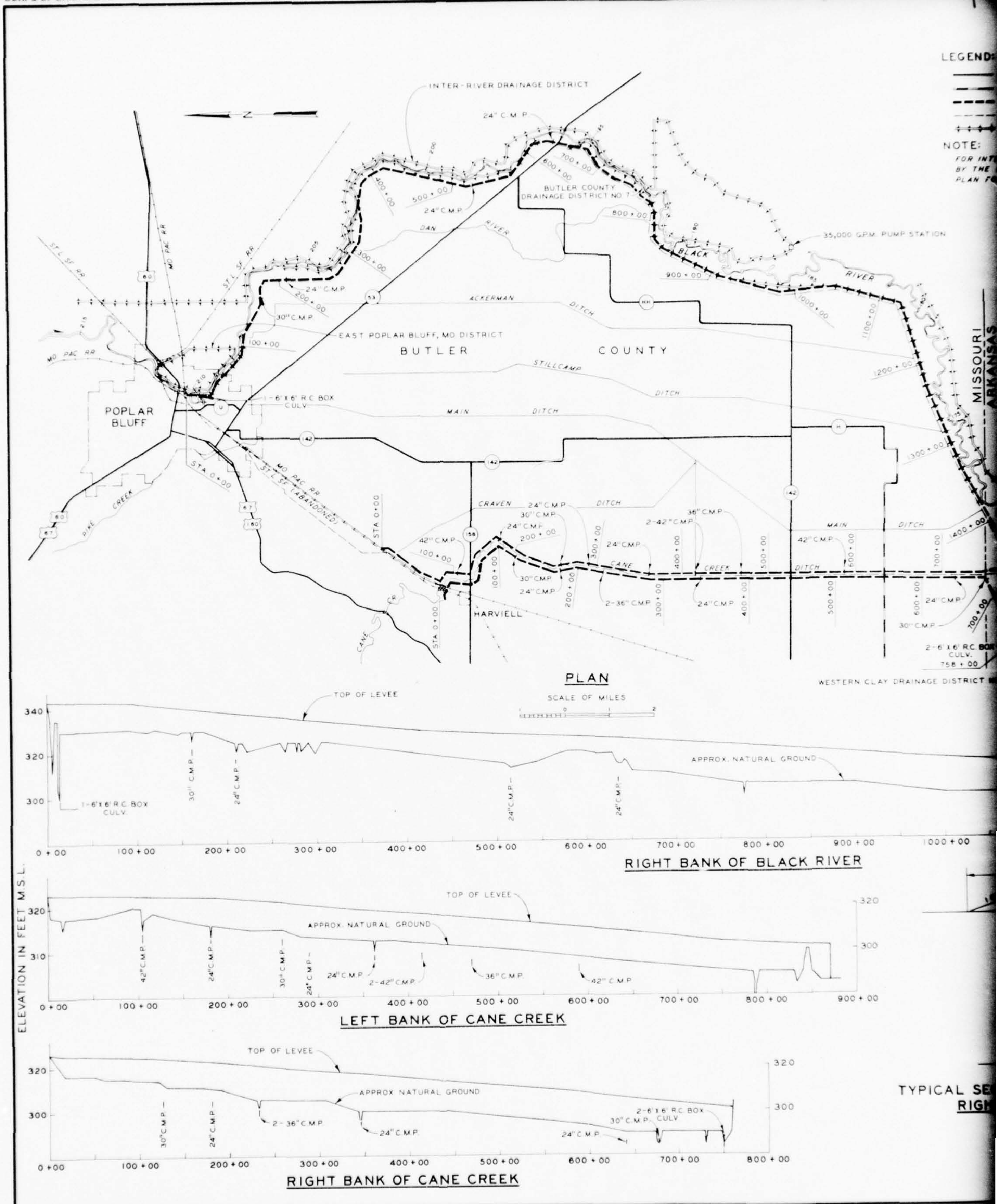
SCALE OF FEET

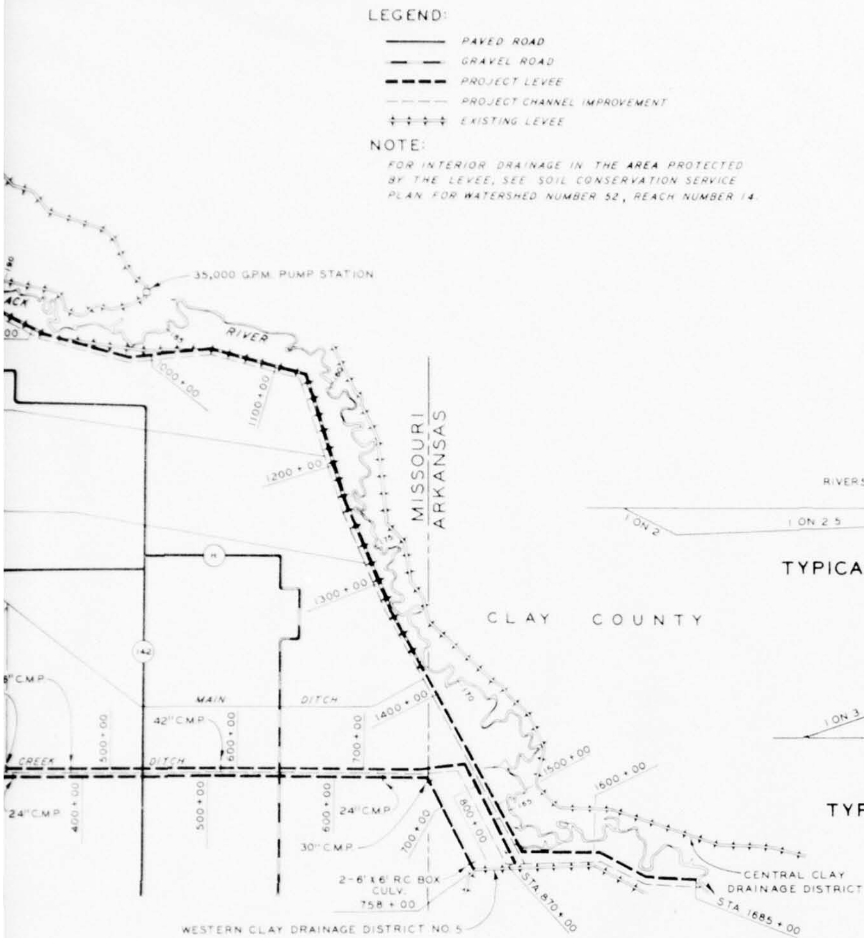
2000 1000 0 2000 4000 6000

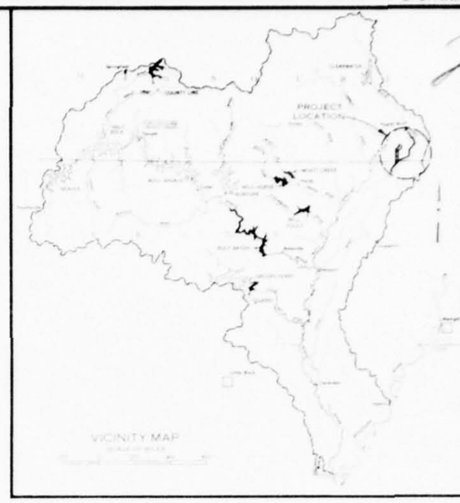
TO ACCOMPANY
REPORT DATED
JUNE 1968

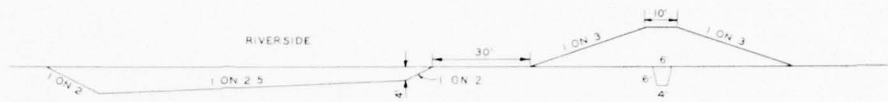
PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS

CORPS OF ENGINEERS

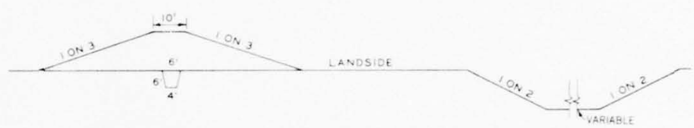




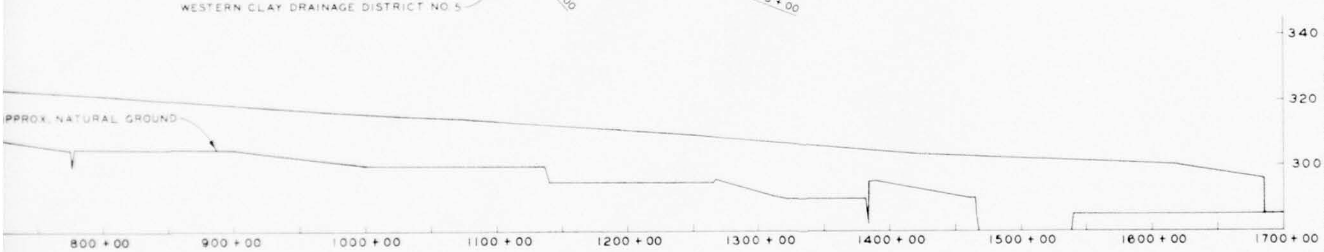




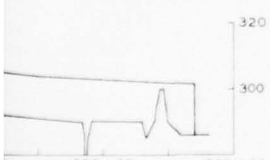
TYPICAL SECTION, STA. 92 + 00 TO STA. 640 + 00
RIGHT BANK OF BLACK RIVER
SCALE OF FEET
20' 0 20'

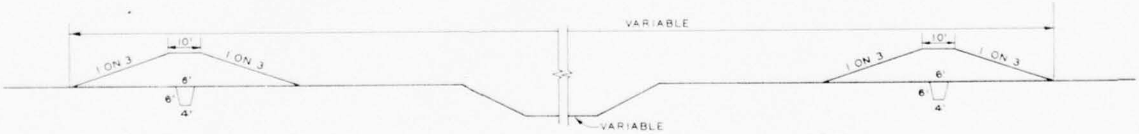


TYPICAL SECTION, STA. 640 + 00 TO STA. 1685 + 00
RIGHT BANK OF BLACK RIVER
SCALE OF FEET
20 0 20

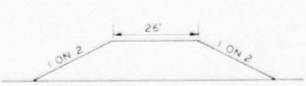


...NK OF BLACK RIVER





TYPICAL SECTION, CANE CREEK
SCALE OF FEET
20' 0 20'



TYPICAL SECTION, STA. 0 + 00 TO STA. 92 + 00
RIGHT BANK OF BLACK RIVER
SCALE OF FEET
20 0 20

WHITE RIVER BASIN
MISSOURI AND ARKANSAS
COMPREHENSIVE BASIN STUDY

BLACK RIVER - CANE CREEK LEVEE

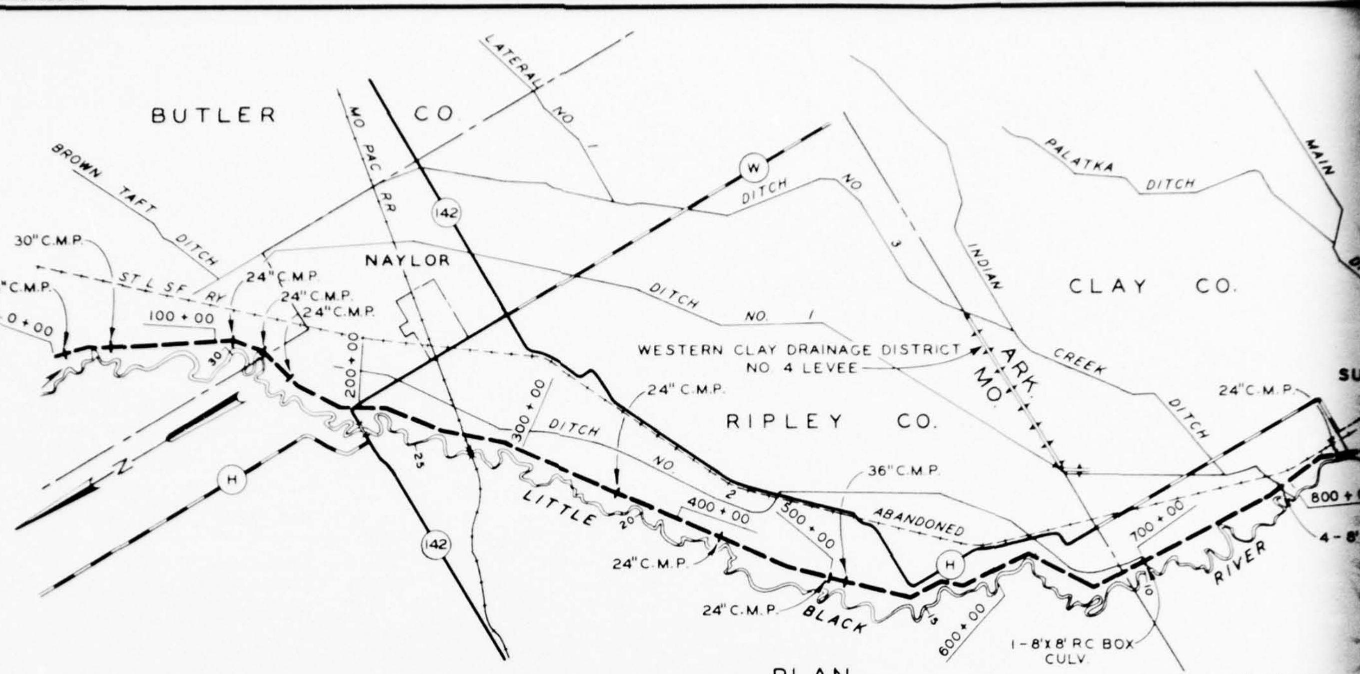
BUTLER COUNTY, MO.,
AND CLAY COUNTY, ARK.

PLAN, PROFILE AND SECTION

SCALE AS SHOWN

TO ACCOMPANY REPORT DATED JUNE 1968

PREPARED BY LITTLE ROCK DISTRICT CORPS OF ENGINEERS

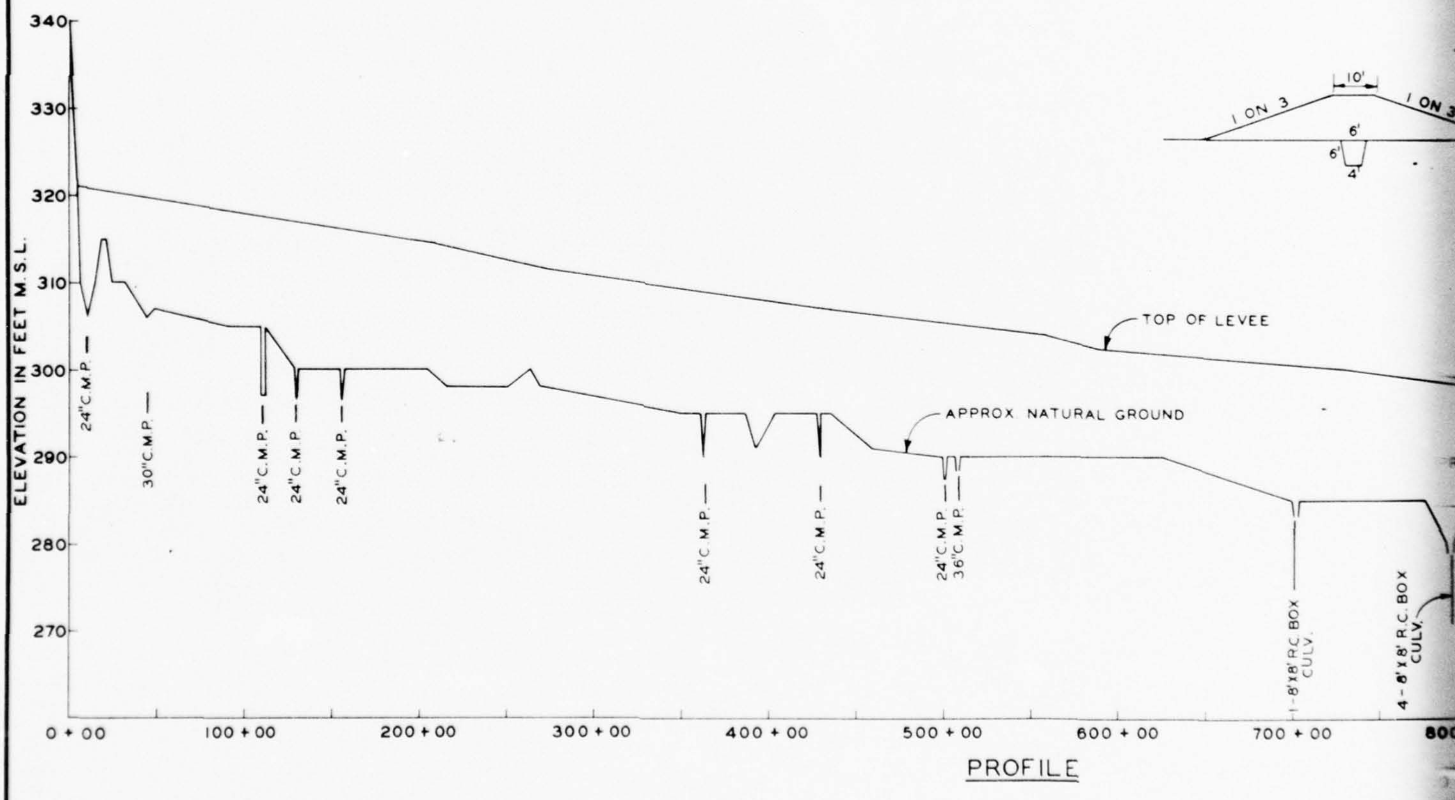


PLAN

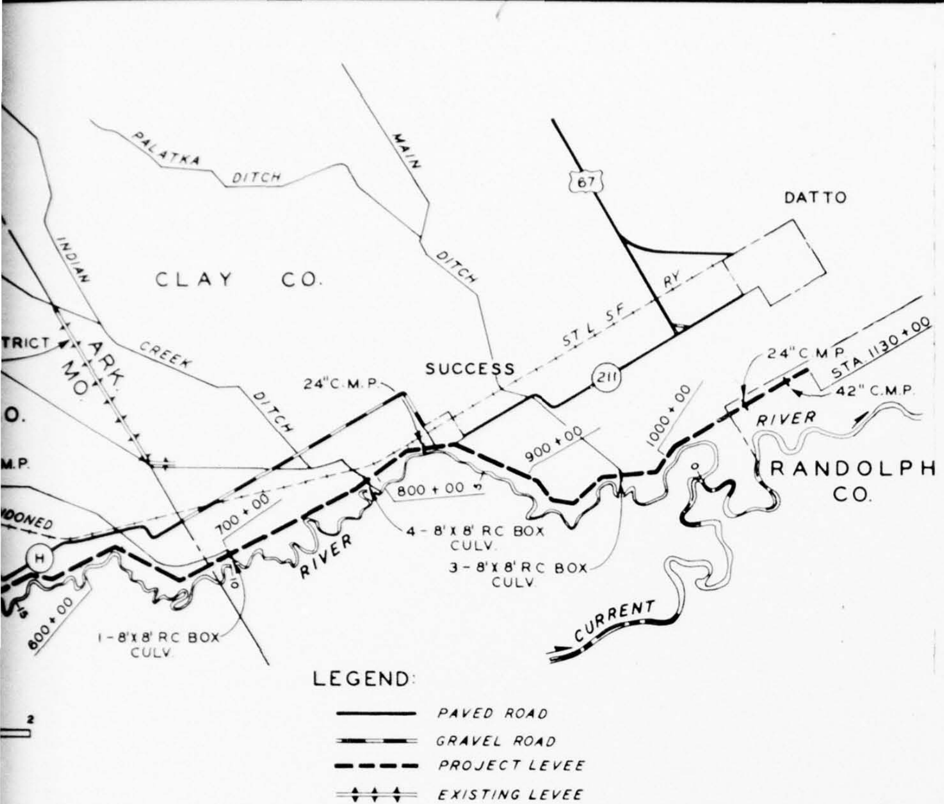
SCALE OF MILES

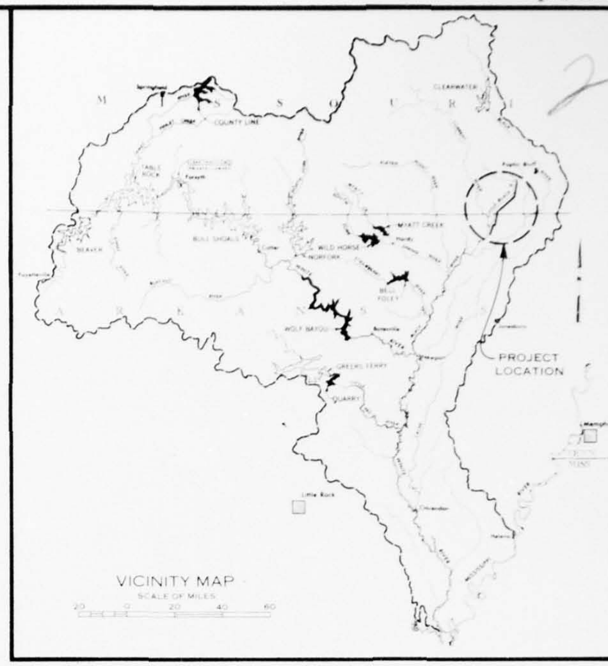
NOTE:

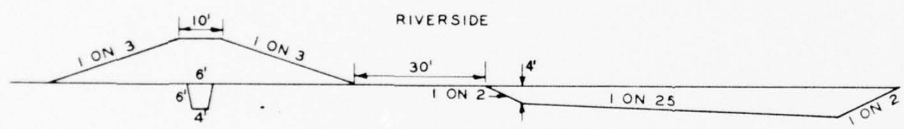
FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 65 & 66, REACH NUMBER 15.



PROFILE

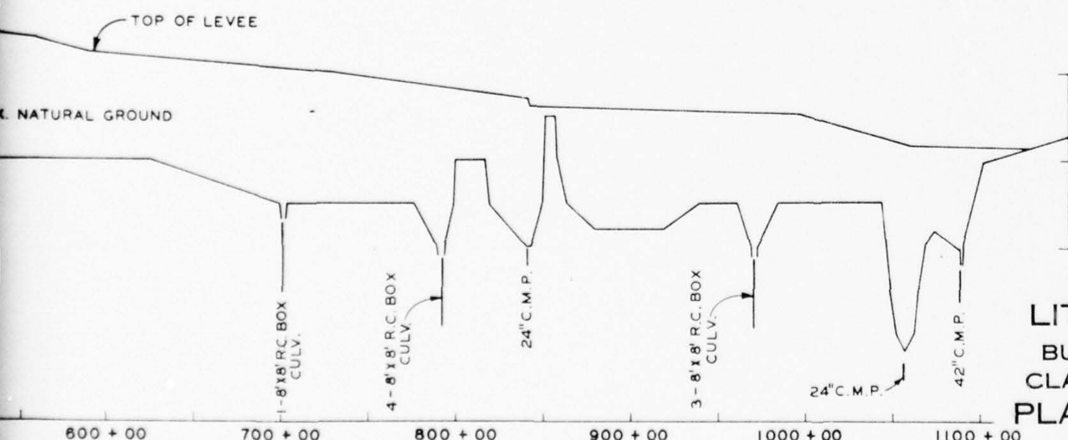






TYPICAL SECTION

SCALE OF FEET



OFILE

WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

LITTLE BLACK RIVER LEVEE

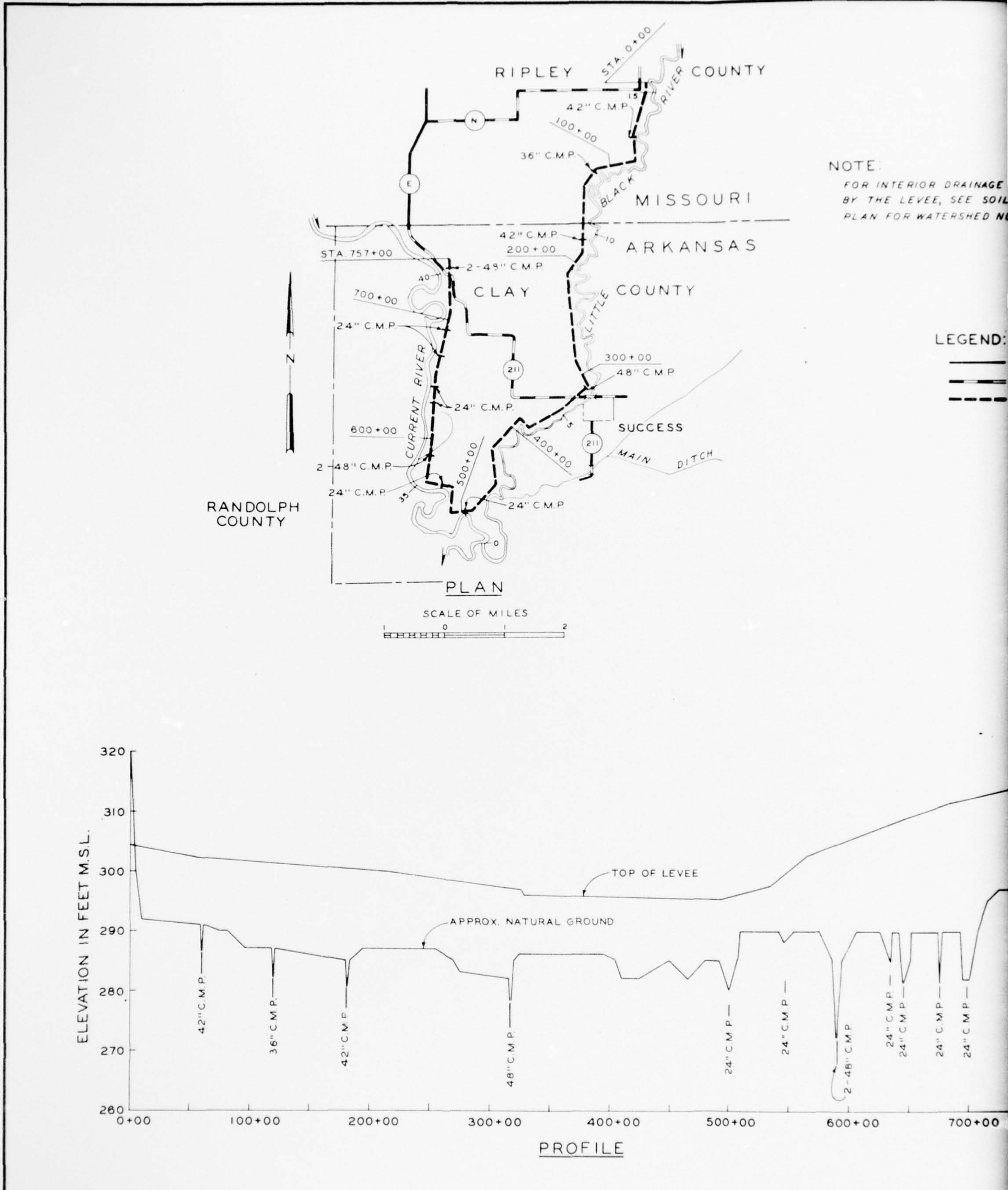
BUTLER AND RIPLEY COUNTIES, MO.,
CLAY AND RANDOLPH COUNTIES, ARK

PLAN, PROFILE AND SECTION

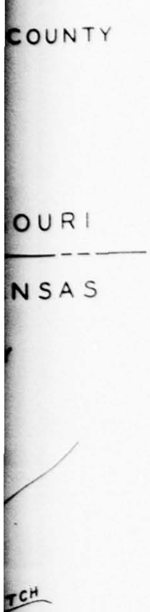
SCALE AS SHOWN

TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS


RIPLEY
STA. 0+00
COUNTY
BLACK RIVER
42" C.M.P.
100+00
36" C.M.P.
NOTE:
FOR INTERIOR DRAINAGE
BY THE LEVEE, SEE SOIL
PLAN FOR WATERSHED N
MISSOURI
ARKANSAS
42" C.M.P.
200+00
STA. 757+00
2-48" C.M.P.
CLAY
COUNTY
700+00
24" C.M.P.
LITTLE
LEGEND:
N
CURRENT RIVER
300+00
48" C.M.P.
24" C.M.P.
SUCCESS
600+00
400+00
500+00
MAIN DITCH
2-48" C.M.P.
24" C.M.P.
24" C.M.P.
RANDOLPH COUNTY
PLAN
SCALE OF MILES
ELEVATION IN FEET M.S.L.
TOP OF LEVEE
APPROX. NATURAL GROUND
42" C.M.P.
36" C.M.P.
42" C.M.P.
48" C.M.P.
24" C.M.P.
24" C.M.P.
2-48" C.M.P.
24" C.M.P.
24" C.M.P.
24" C.M.P.
24" C.M.P.
0+00
100+00
200+00
300+00
400+00
500+00
600+00
700+00
PROFILE

U.S. ARMY

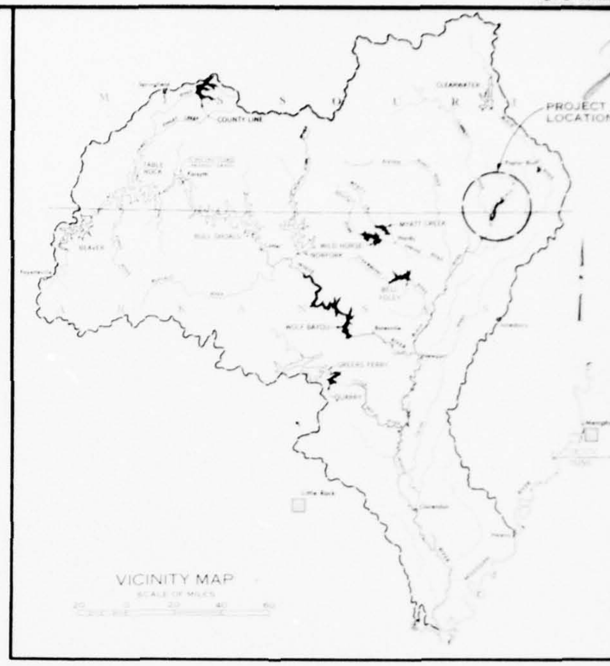


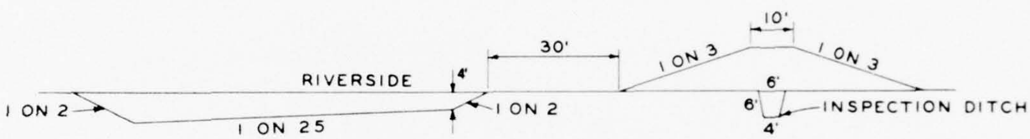
NOTE:

FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 64 & 65, REACH NUMBER 15.

LEGEND:

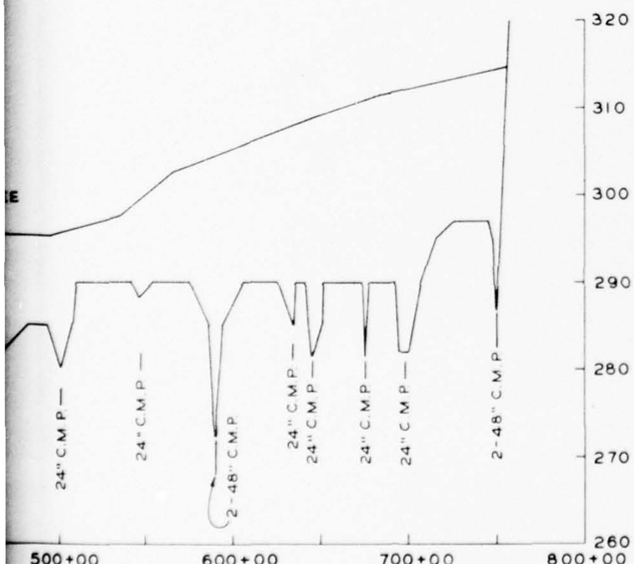
- *PAVED ROAD*
- *GRAVEL ROAD*
- *PROJECT LEVEE*





TYPICAL SECTION

SCALE OF FEET
20' 0' 20'



WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

CURRENT-LITTLE BLACK RIVERS LEVEE

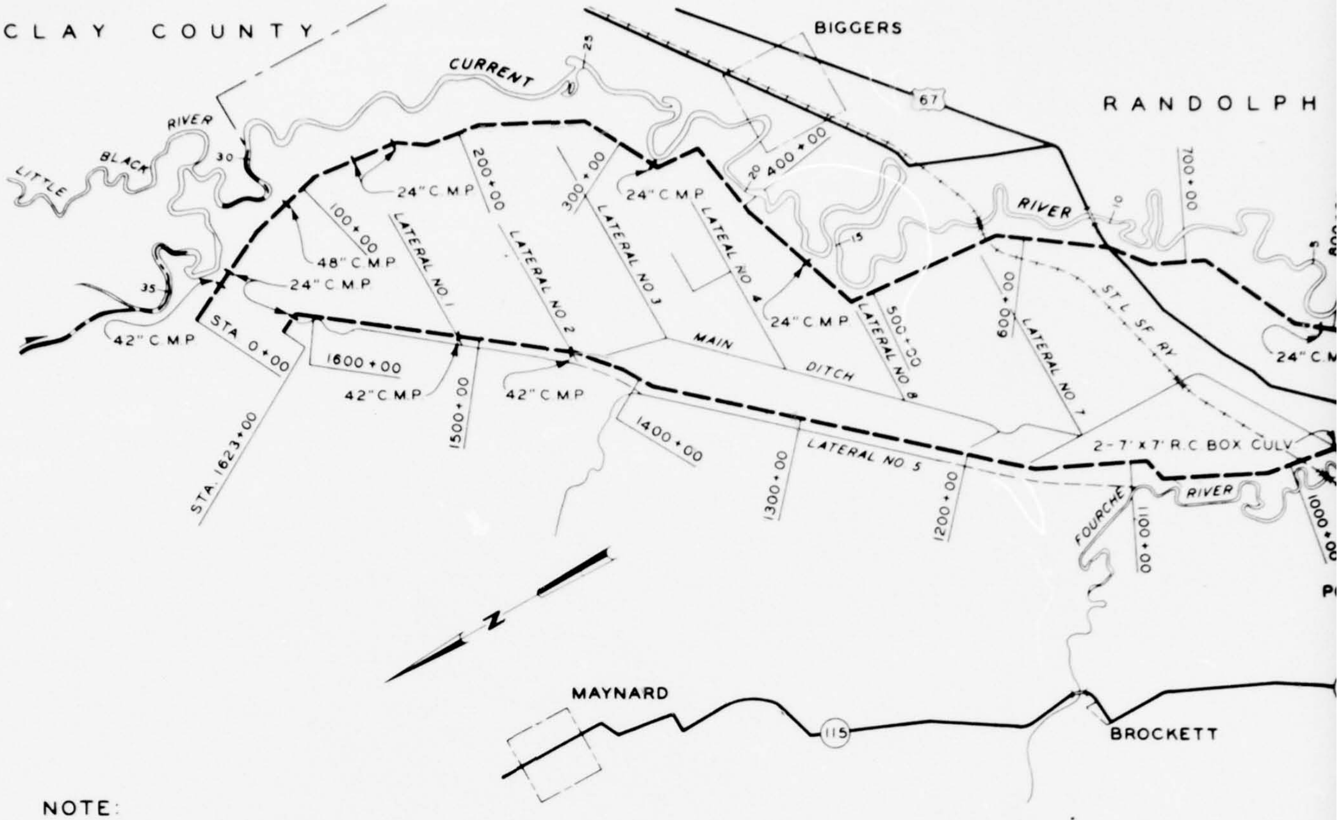
RIPLEY COUNTY, MO. AND
CLAY COUNTY, ARK.

PLAN, PROFILE AND SECTION

SCALE AS SHOWN

TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS



NOTE:

FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 67, REACH NUMBER 15.

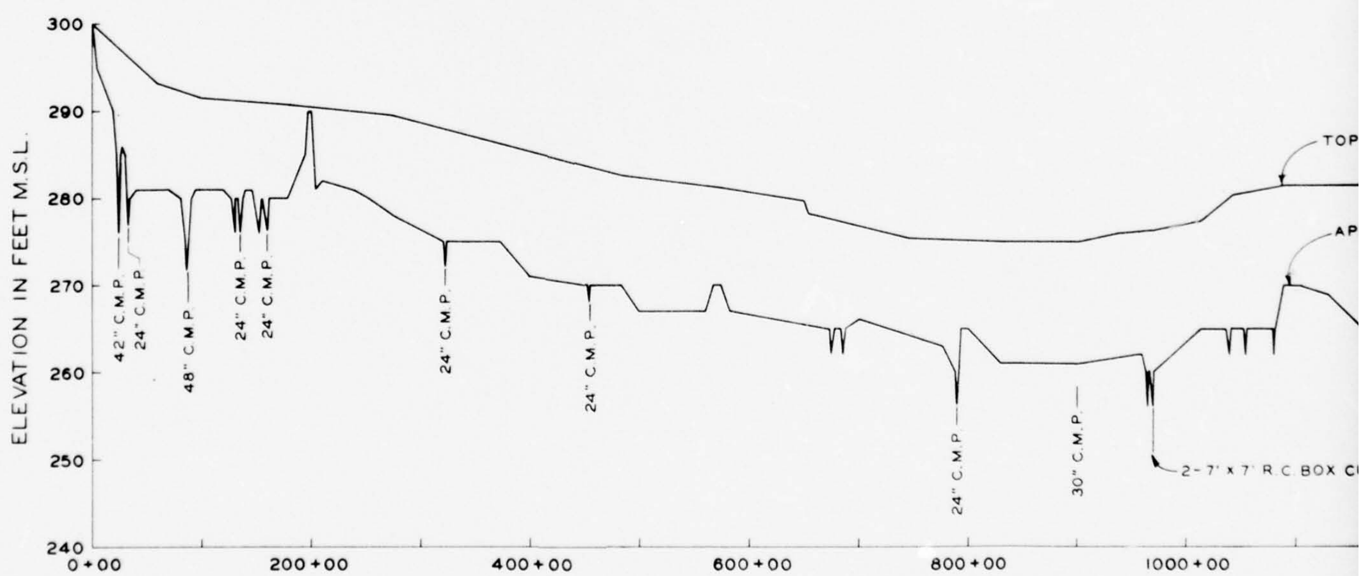
PLAN

SCALE OF MILES

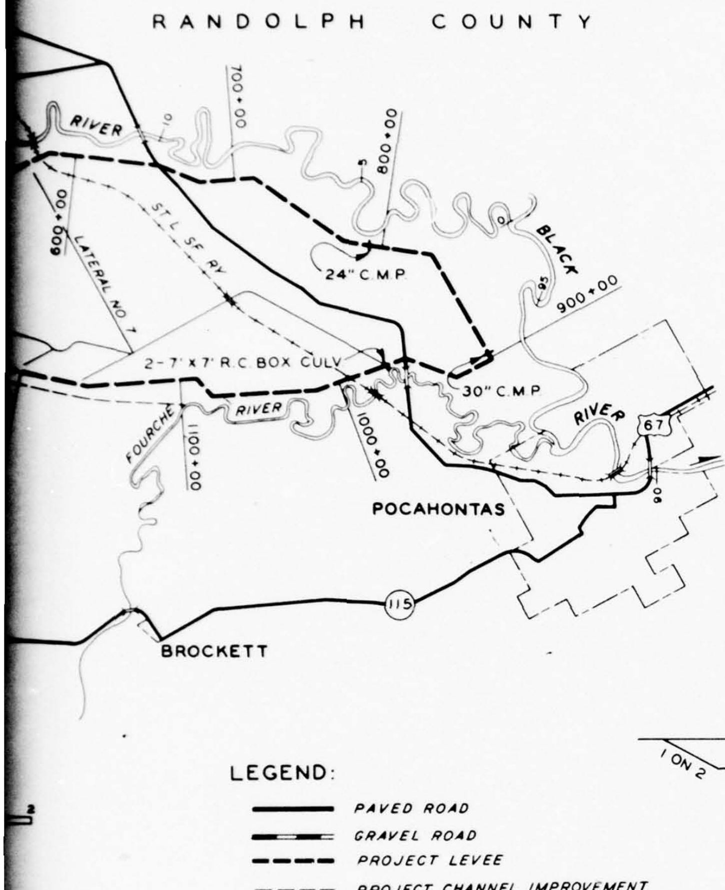
1 0 1 2

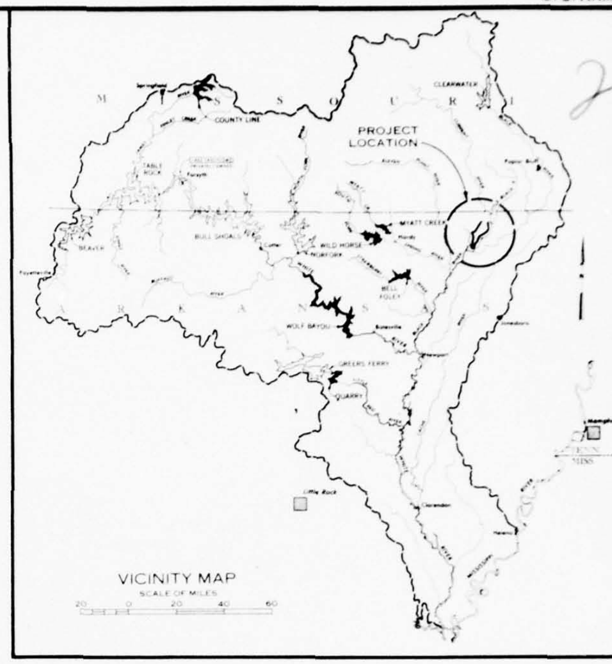
LEGEND:

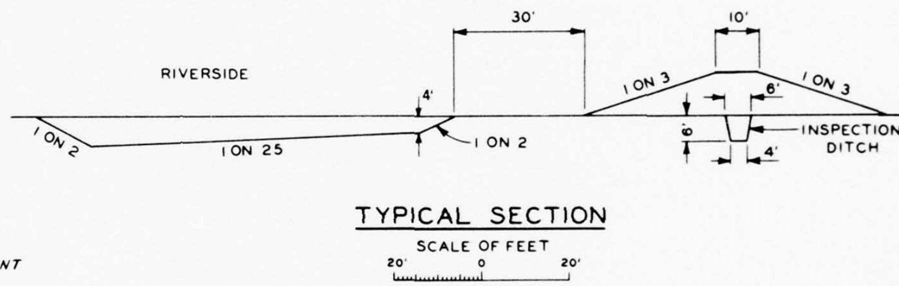
PAV
GRA
PRO
PRO

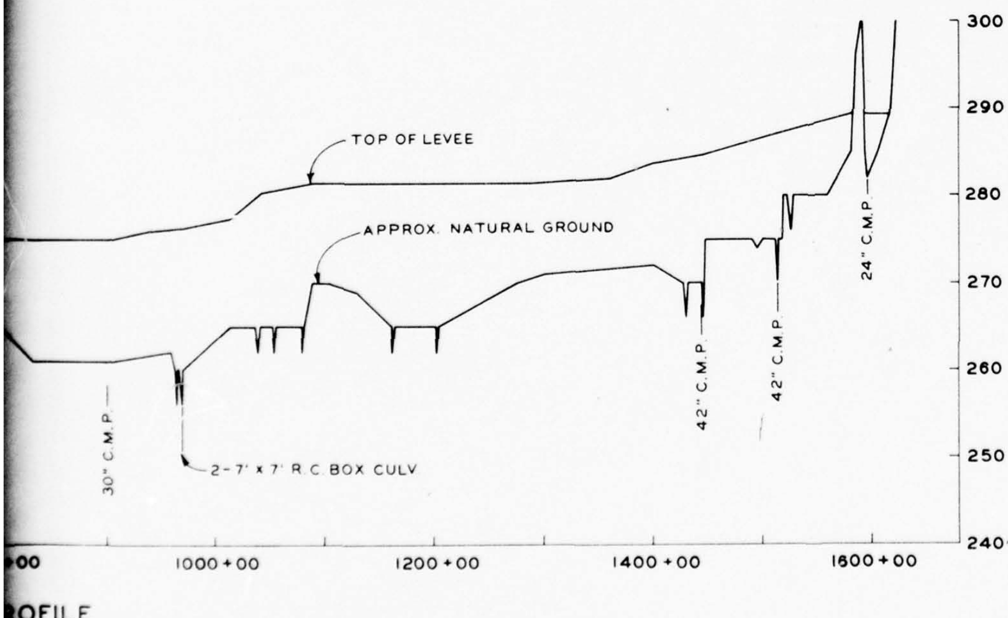


PROFILE









WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

BLACK - CURRENT - FOURCHE RIVERS LEVEE

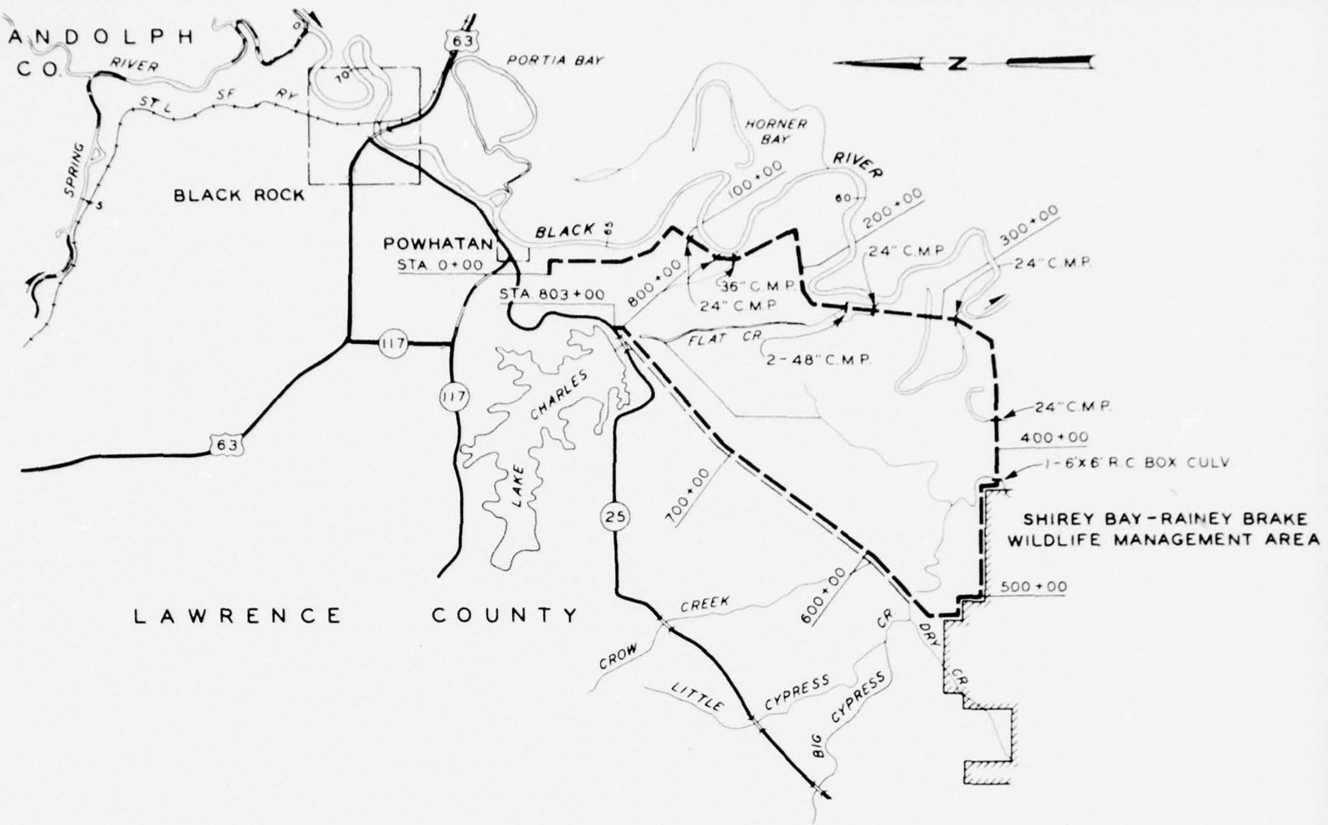
RANDOLPH COUNTY, ARK.

PLAN, PROFILE AND SECTION

SCALE AS SHOWN

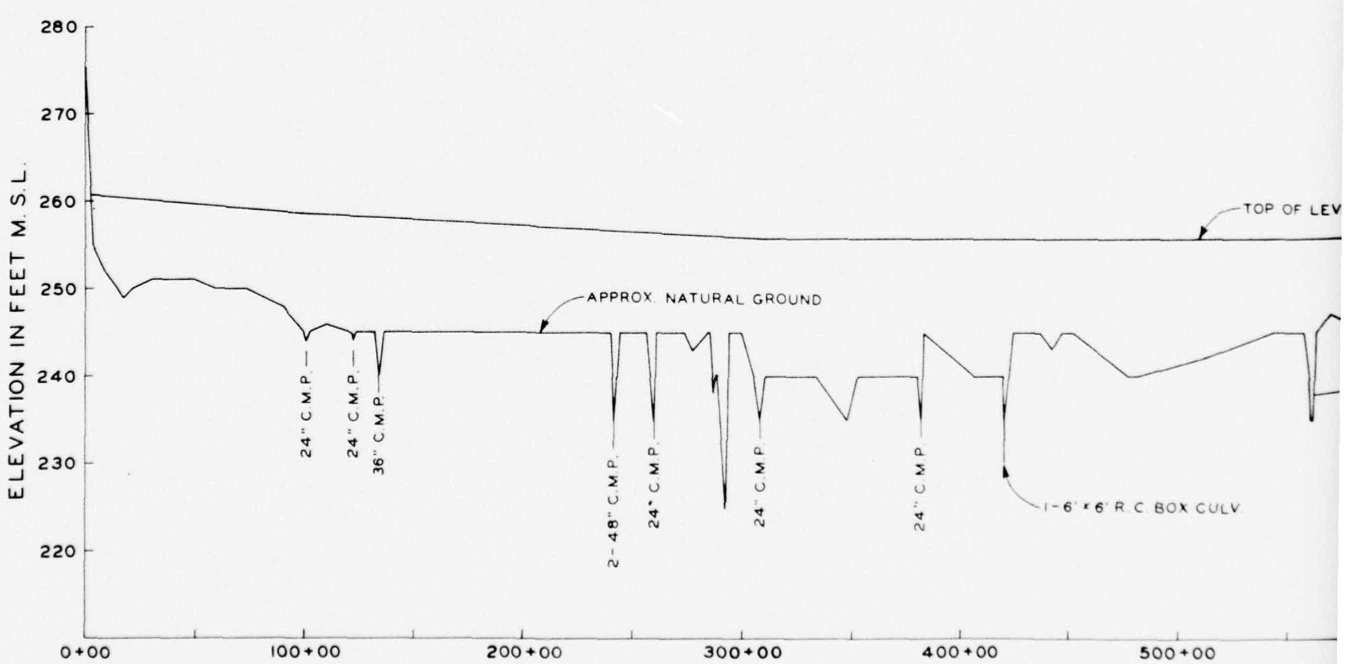
TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS



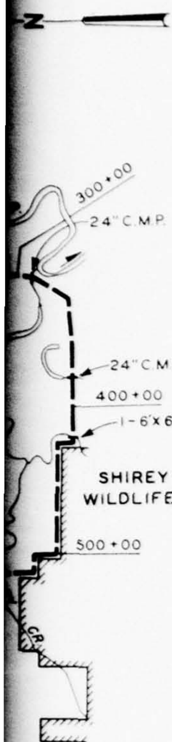
PLAN

SCALE OF MILES



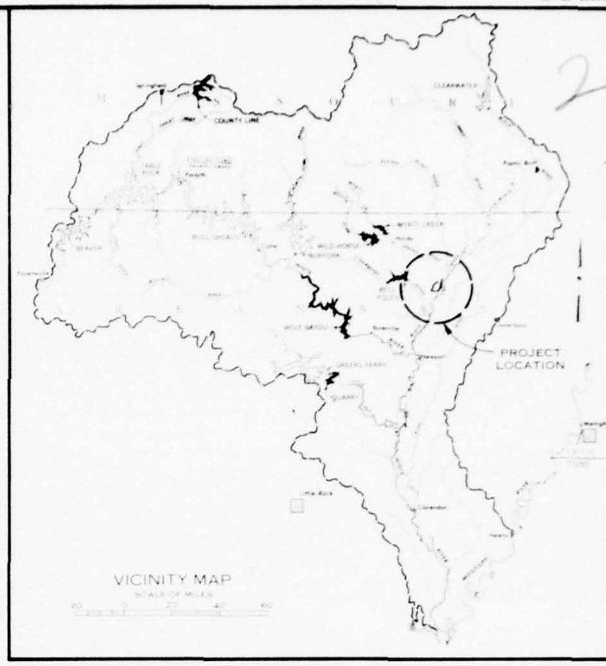
PROFILE

U.S. ARMY



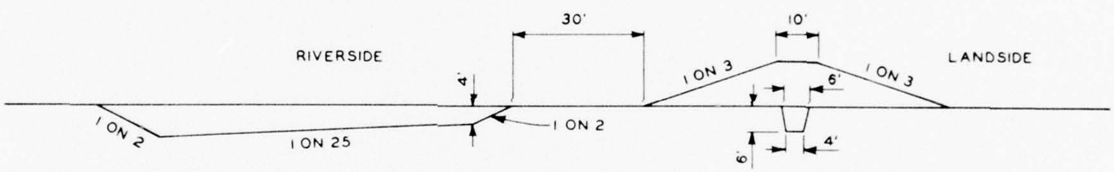
LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- PROJECT LEVEE
- PROJECT CHANNEL IMPROVEMENT



NOTE:

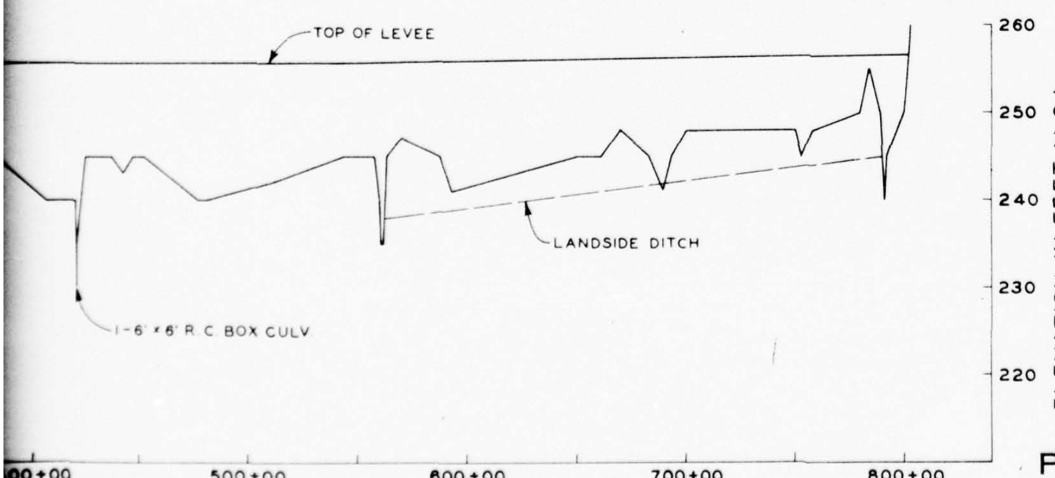
FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 80, REACH NUMBER 18.



TYPICAL SECTION

SCALE OF FEET

20' 0 20'



PROFILE

WHITE RIVER BASIN
MISSOURI AND ARKANSAS
COMPREHENSIVE BASIN STUDY

FLAT CREEK LEVEE

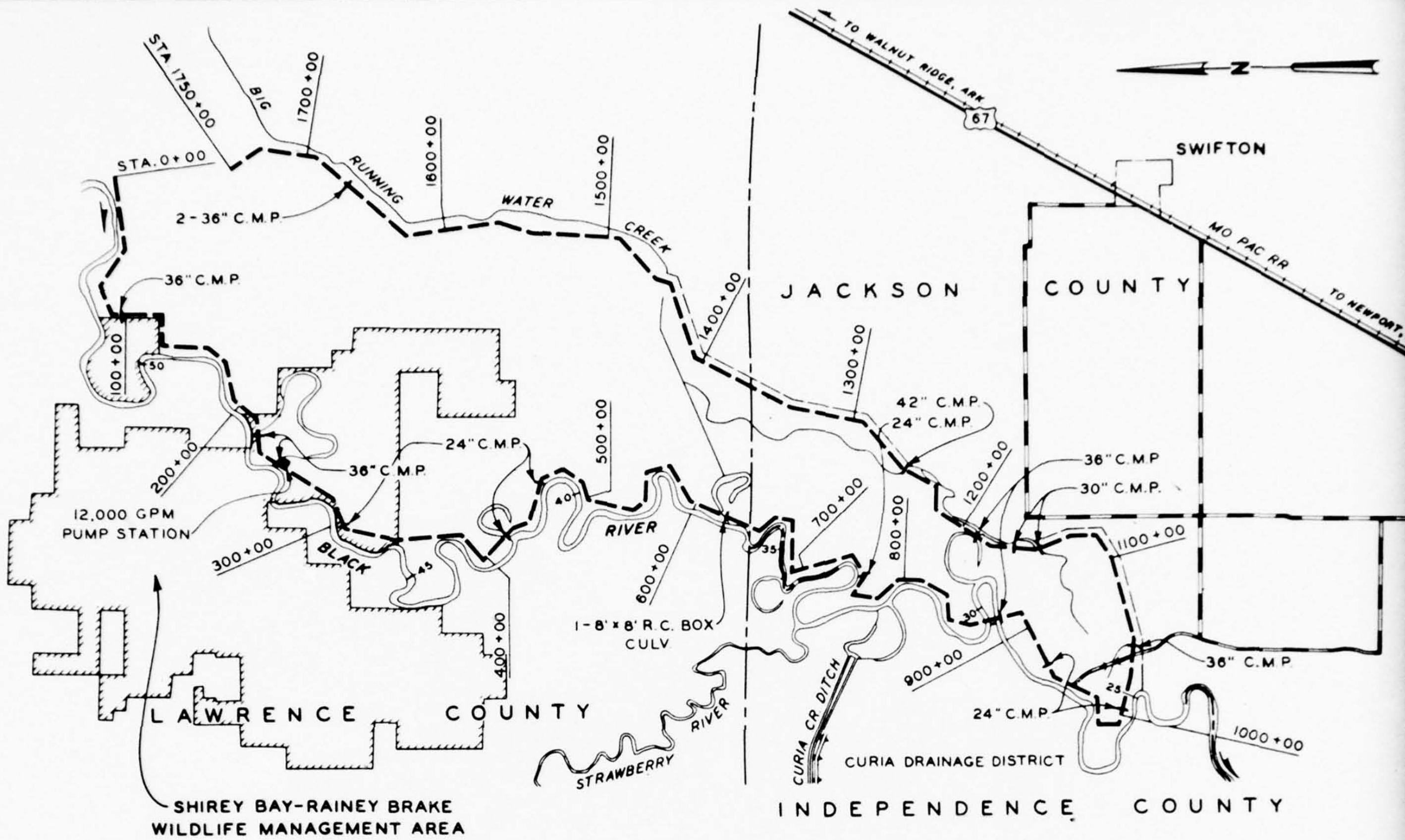
LAWRENCE COUNTY, ARKANSAS

PLAN, PROFILE AND SECTION

SCALE AS SHOWN

TO ACCOMPANY
REPORT DATED
JUNE 1968

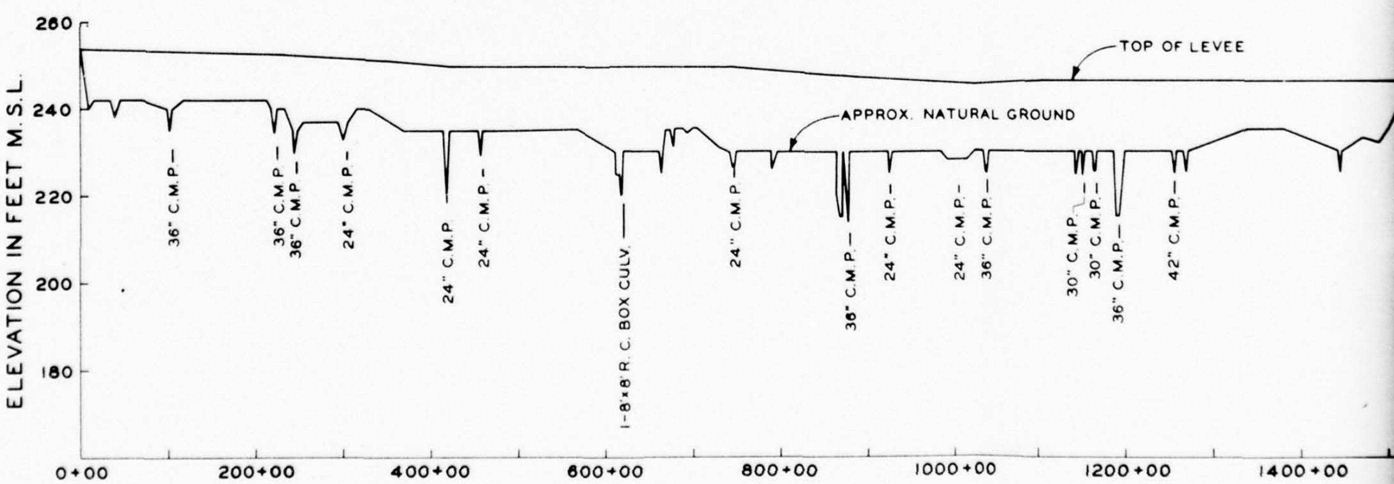
PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS



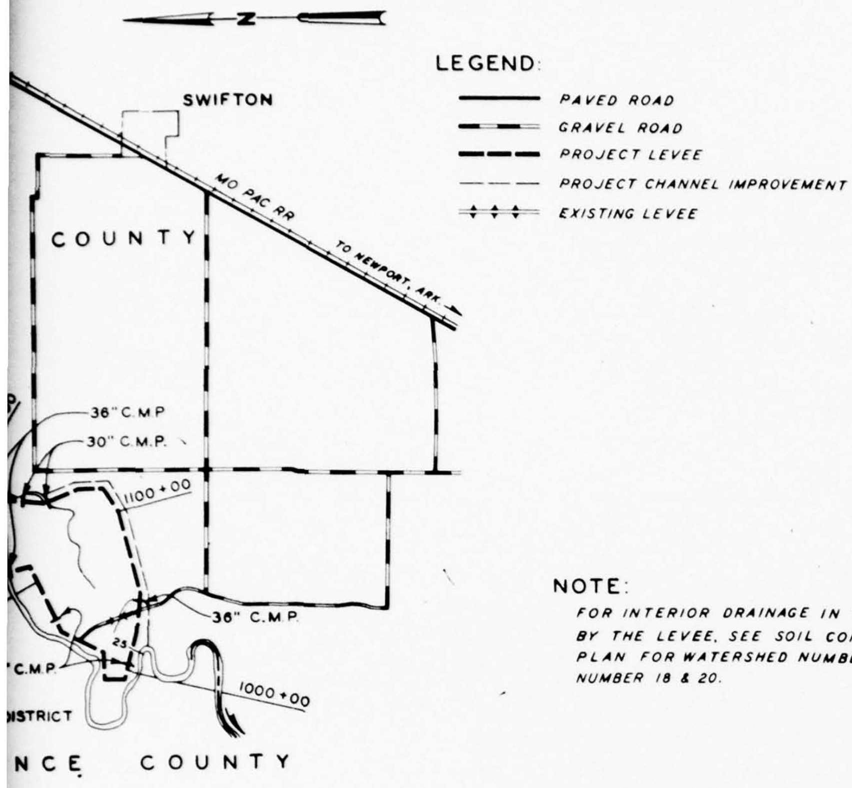
PLAN

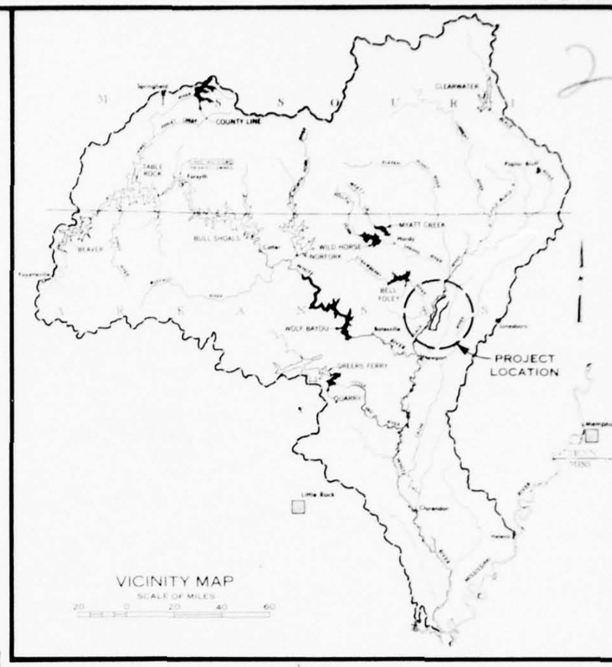
SCALE OF MILES

1 0 1 2



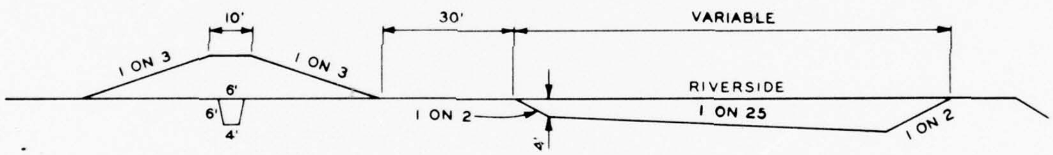
PROFILE





NOTE:

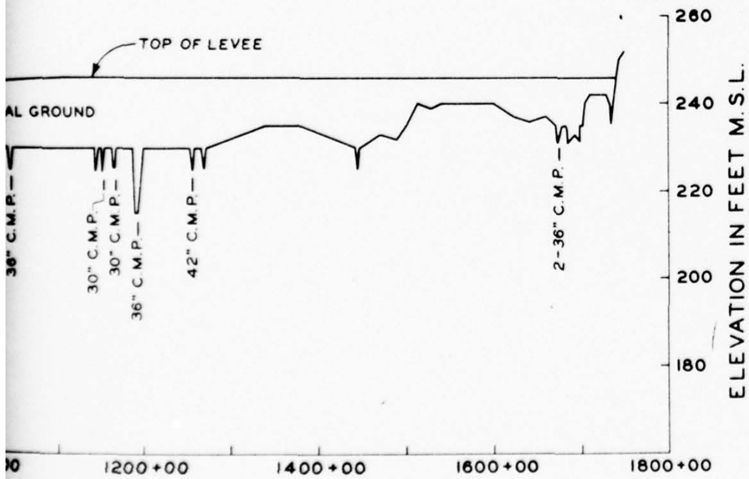
FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 69 & 82, REACH NUMBER 18 & 20.



TYPICAL SECTION

SCALE OF FEET

20' 0 20'



WHITE RIVER BASIN

MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

CLOVER BEND LEVEE

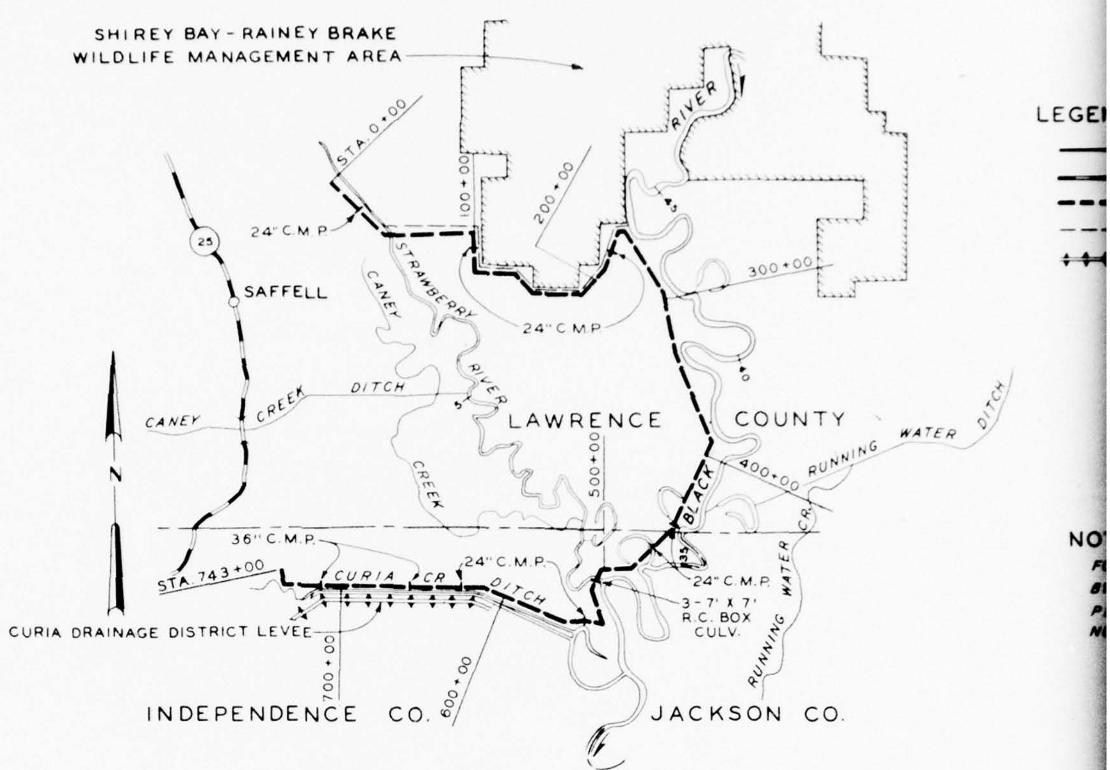
LAWRENCE, JACKSON AND INDEPENDENCE COUNTIES, ARK.

PLAN, PROFILE AND SECTION

SCALE AS SHOWN

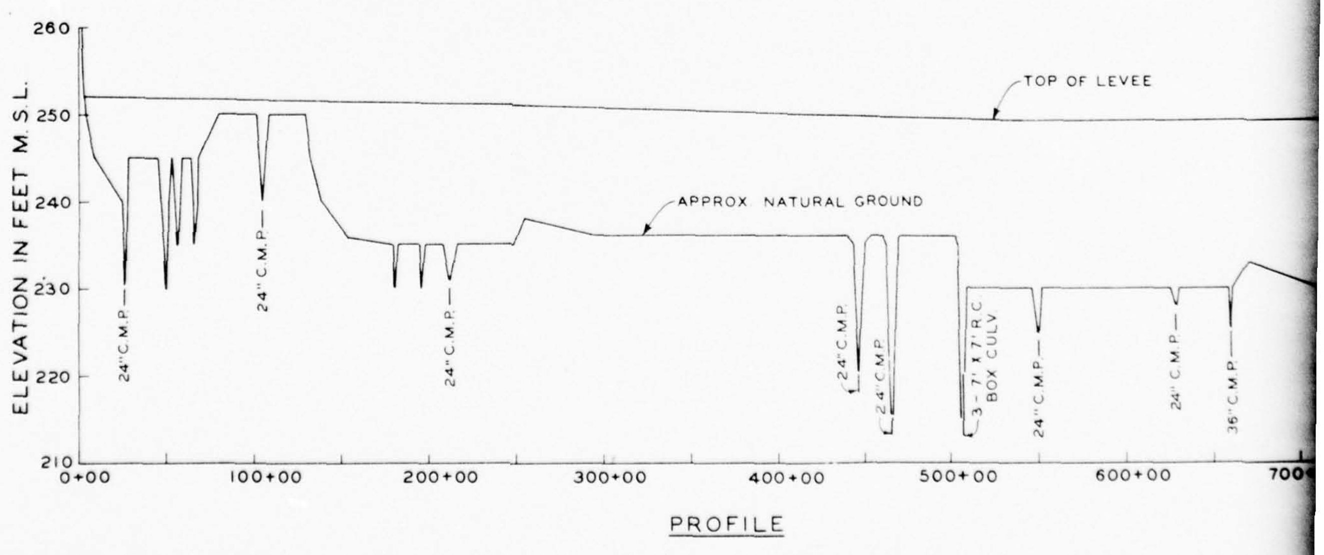
TO ACCOMPANY REPORT DATED JUNE 1968

PREPARED BY LITTLE ROCK DISTRICT CORPS OF ENGINEERS

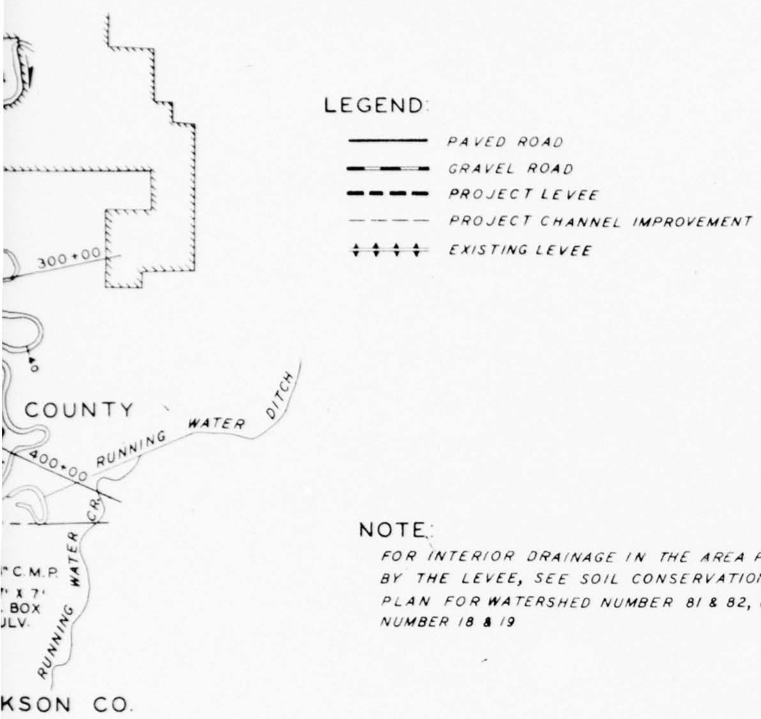


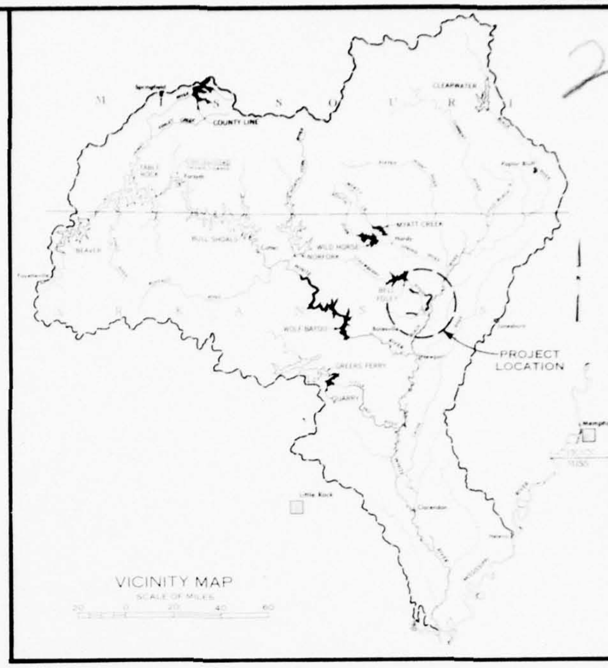
PLAN

SCALE OF MILES



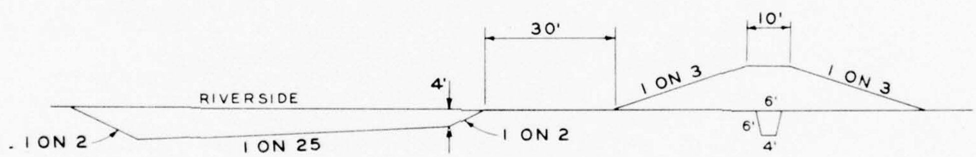
PROFILE





NOTE:

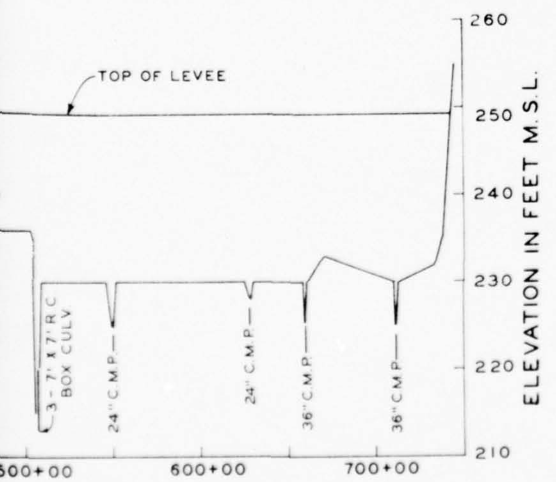
FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 81 & 82, REACH NUMBER 18 & 19



TYPICAL SECTION

SCALE OF FEET

20' 0' 20'



WHITE RIVER BASIN

MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

BLACK - STRAWBERRY RIVERS LEVEE

INDEPENDENCE AND LAWRENCE COUNTIES, ARKANSAS

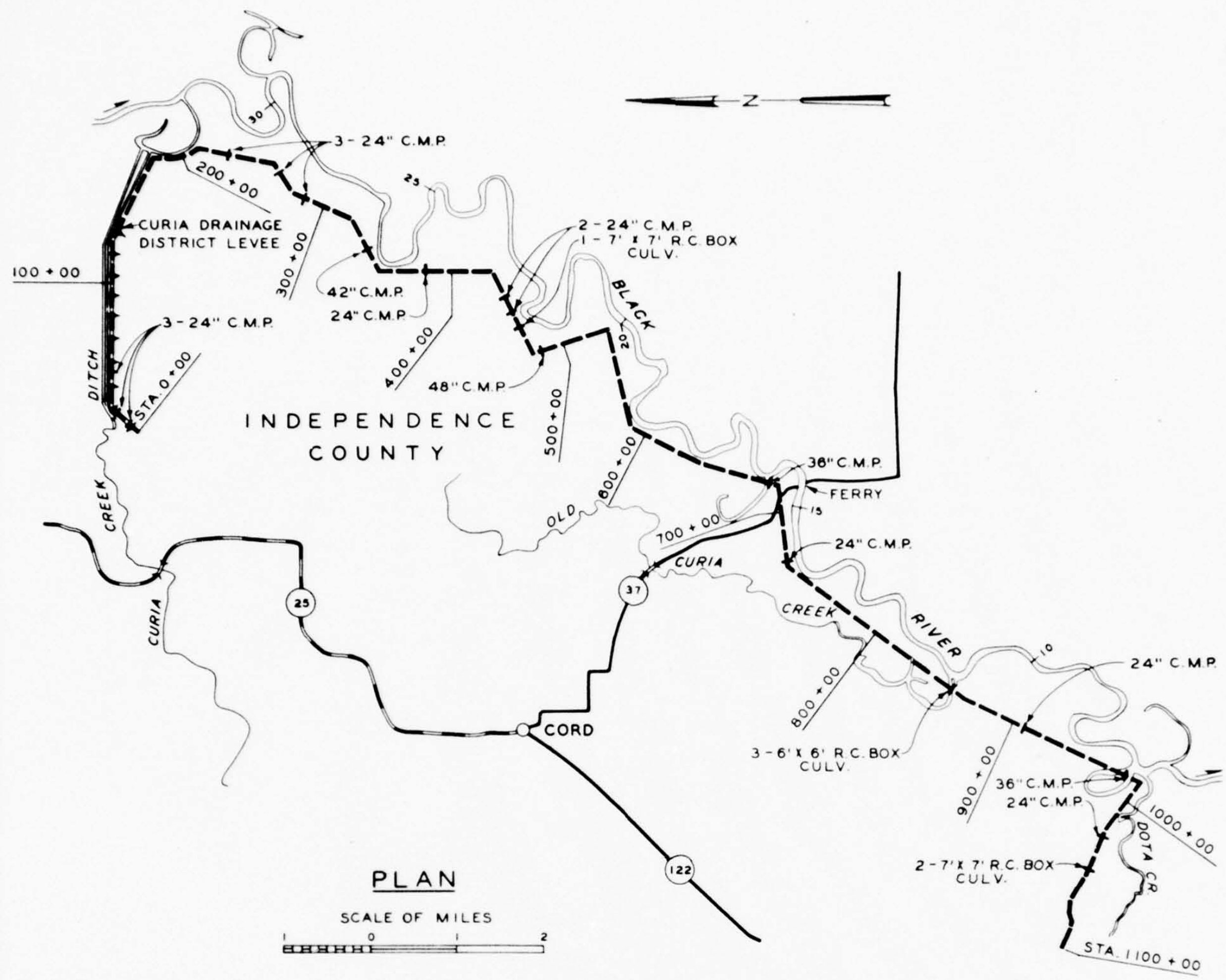
PLAN, PROFILE AND SECTION

SCALE AS SHOWN

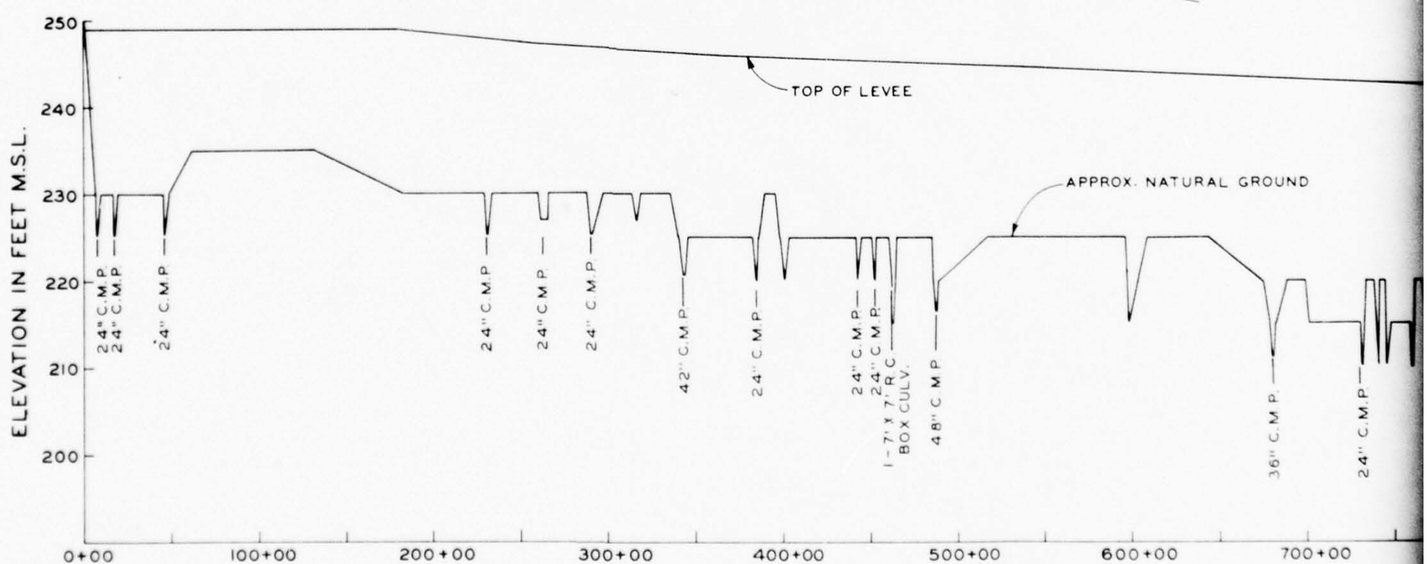
TO ACCOMPANY REPORT DATED JUNE 1968

PREPARED BY LITTLE ROCK DISTRICT CORPS OF ENGINEERS

NOTE:
FOR INTERIOR DR... BY THE LEVEE, SE... PLAN FOR WATERS...



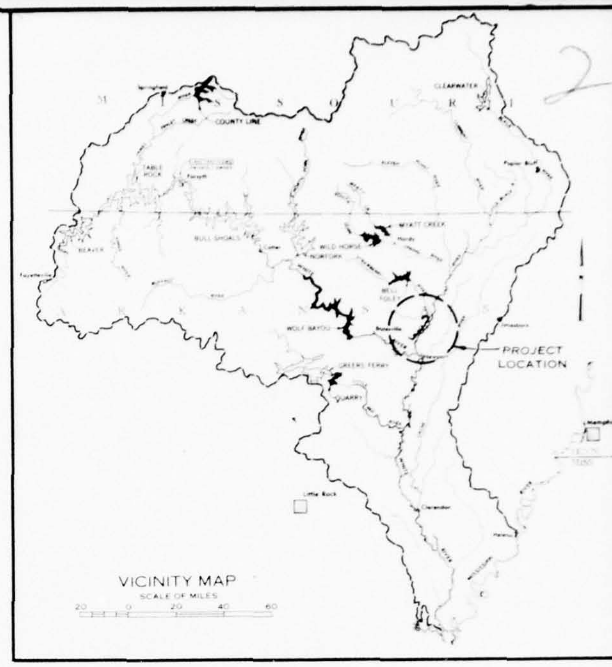
PLAN



PROFILE

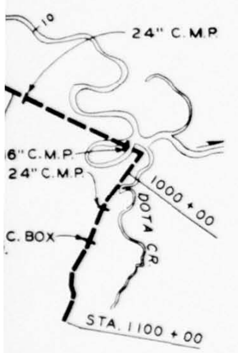
NOTE:

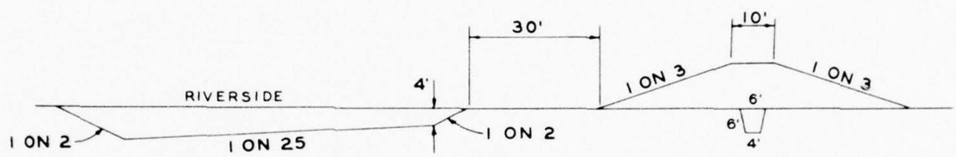
FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 87, REACH NUMBER 19.



LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- PROJECT LEVEE
- EXISTING LEVEE

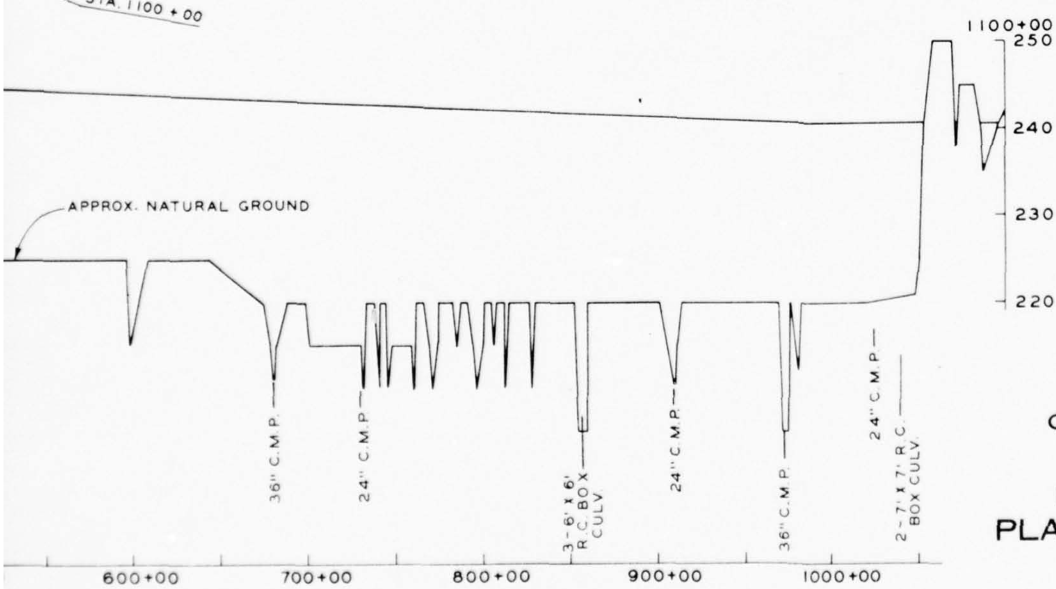




TYPICAL SECTION

SCALE OF FEET

20' 0' 20'



PROFILE

WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

CURIA CREEK LEVEE

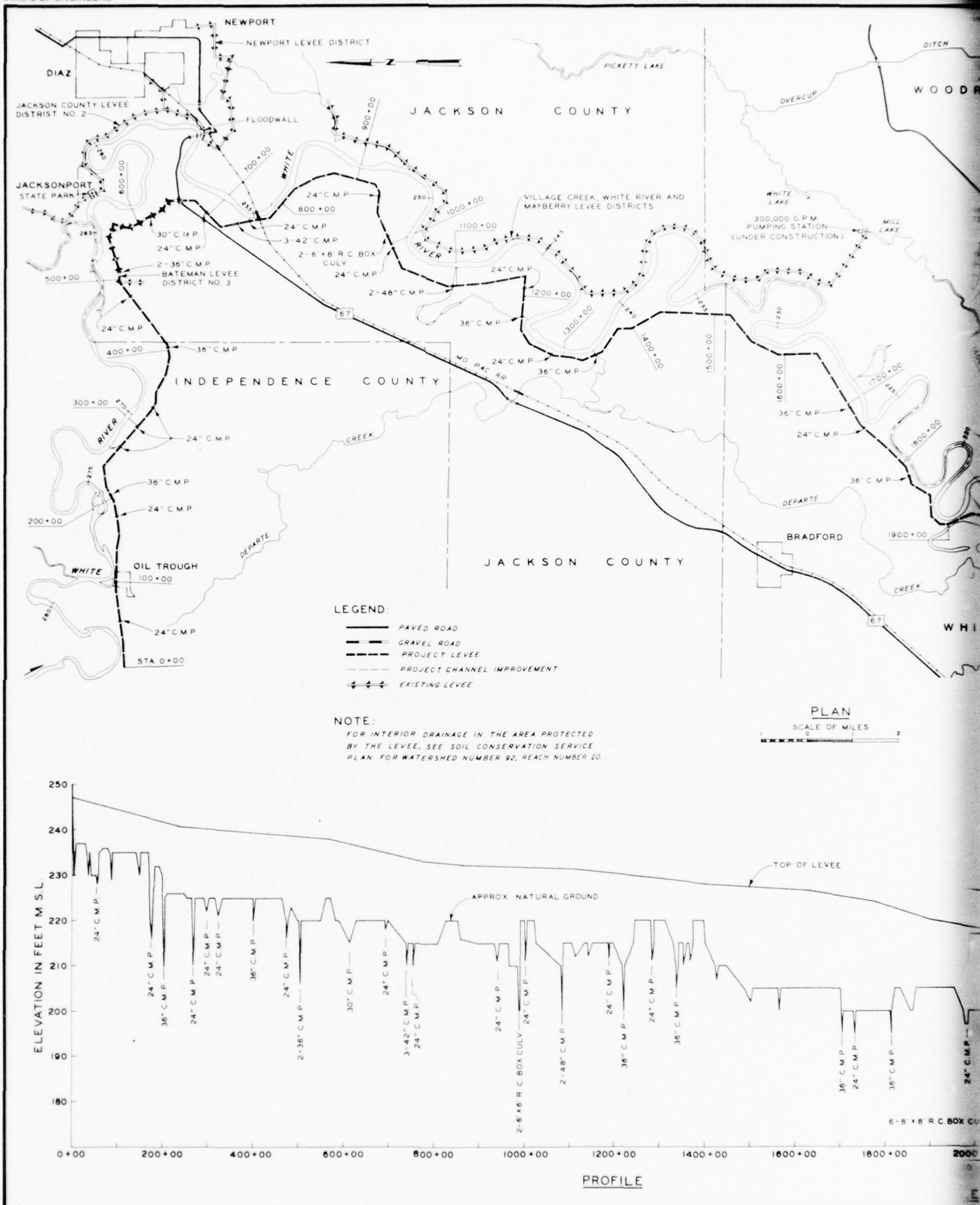
INDEPENDENCE COUNTY, ARK.

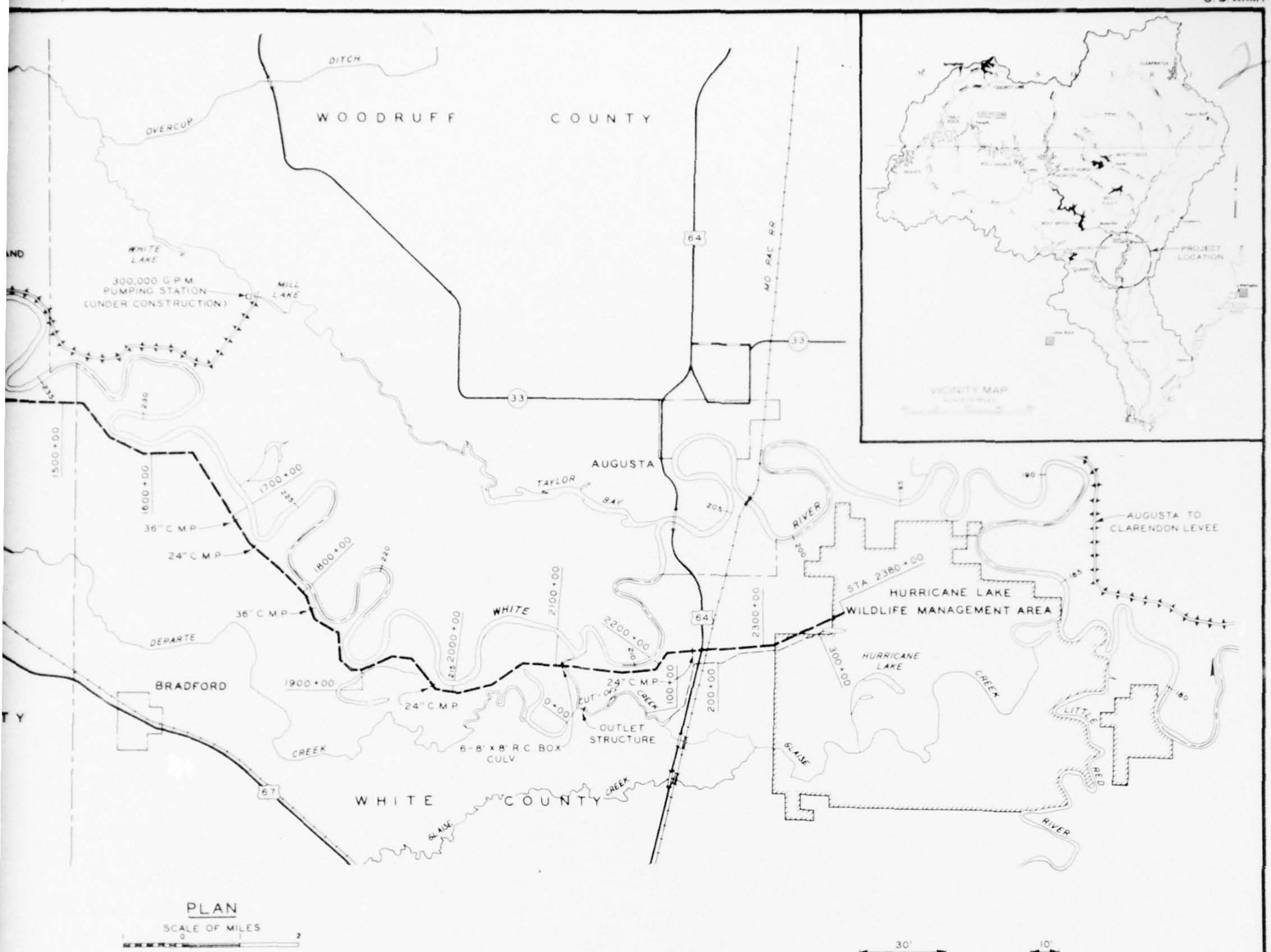
PLAN, PROFILE AND SECTION

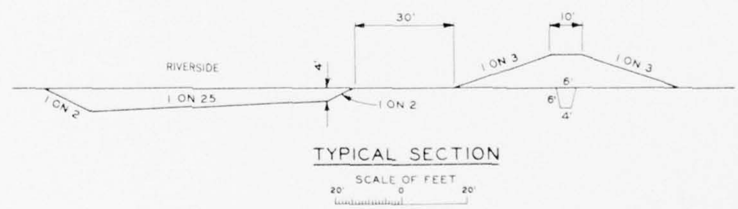
SCALE AS SHOWN

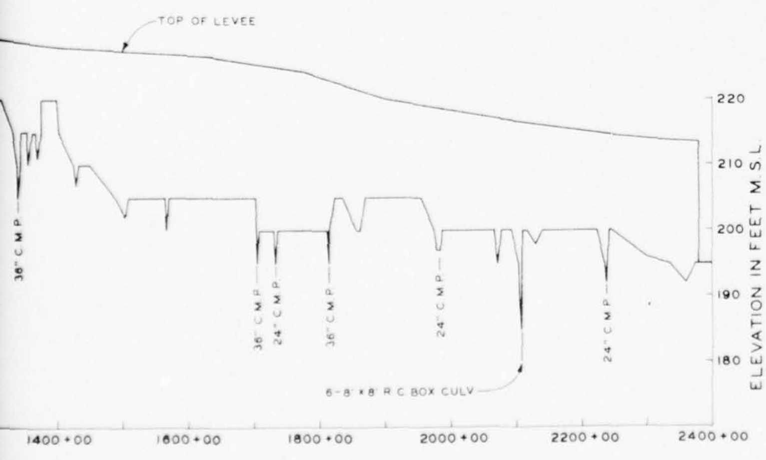
TO ACCOMPANY REPORT DATED JUNE 1968

PREPARED BY LITTLE ROCK DISTRICT CORPS OF ENGINEERS


NEWPORT
NEWPORT LEVEE DISTRICT
DIAZ
JACKSON COUNTY LEVEE DISTRICT NO. 2
FLOODWALL
JACKSONPORT STATE PARK
PICKETT LAKE
JACKSON COUNTY
WOODR
OVERCUP
DITCH
WHITE RIVER
VILLAGE CREEK, WHITE RIVER AND MAYBERRY LEVEE DISTRICTS
WHITE LAKE
300,000 G.P.M. PUMPING STATION (UNDER CONSTRUCTION)
MILL LAKE
BATEMAN LEVEE DISTRICT NO. 3
INDEPENDENCE COUNTY
MO. PAC. RR
67
CREEK
DEPARTE
BRADFORD
OIL TROUGH
JACKSON COUNTY
STA. 0+00
LEGEND:
PAVED ROAD
GRAVEL ROAD
PROJECT LEVEE
PROJECT CHANNEL IMPROVEMENT
EXISTING LEVEE
NOTE:
FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 92, REACH NUMBER 20.
PLAN
SCALE OF MILES
ELEVATION IN FEET M.S.L.
TOP OF LEVEE
APPROX. NATURAL GROUND
2-6'x6' R.C. BOX CULV.
6-8'x8' R.C. BOX CU
PROFILE







WHITE RIVER BASIN
MISSOURI AND ARKANSAS
COMPREHENSIVE BASIN STUDY

OIL TROUGH TO HURRICANE LAKE LEVEE

INDEPENDENCE, JACKSON AND WHITE COUNTIES, ARK.

PLAN, PROFILE AND SECTION

SCALE AS SHOWN

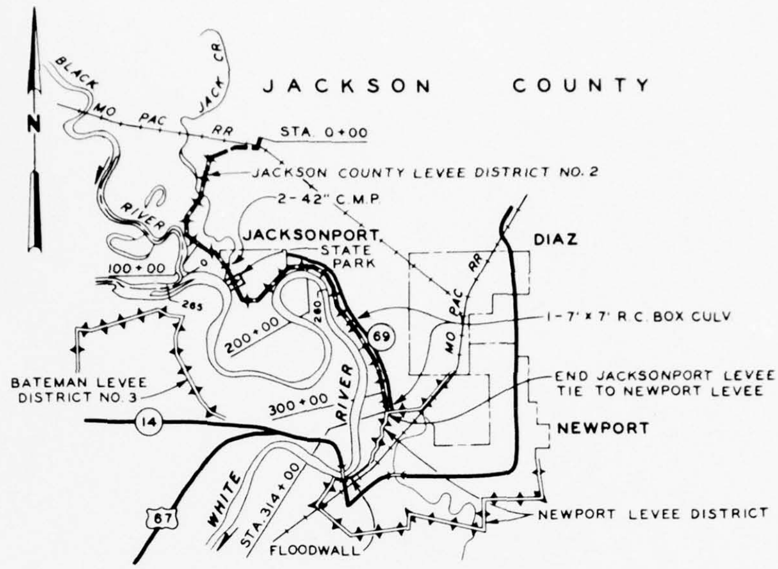
TO ACCOMPANY REPORT DATED JUNE 1968

PREPARED BY LITTLE ROCK DISTRICT CORPS OF ENGINEERS

NOTE:

FOR INTERIOR DRAINAG
BY THE LEVEE, SEE SO
PLAN FOR WATERSHED

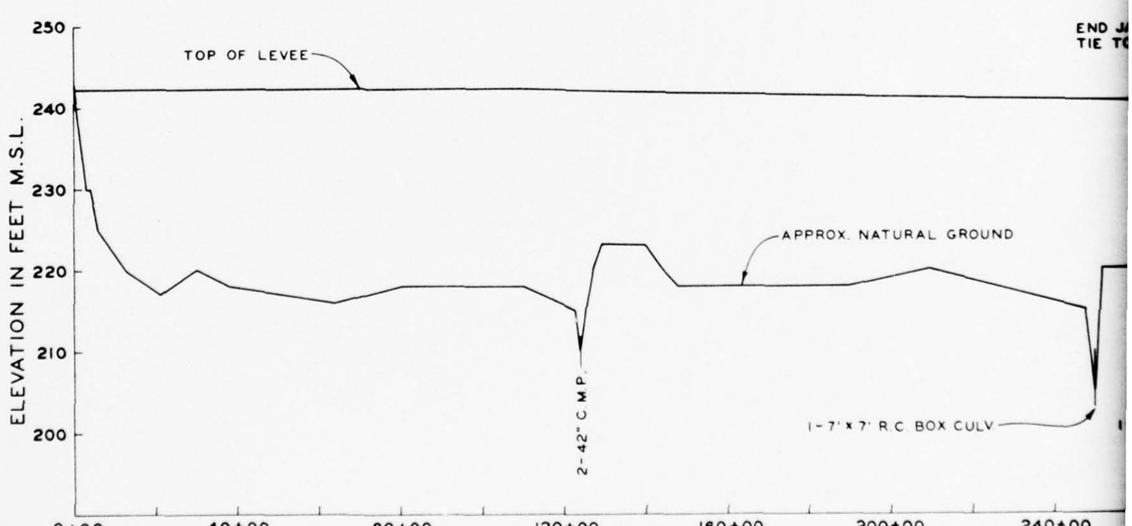
LEGEN



PLAN

SCALE OF MILES

1 0 1 2



PROFILE

NOTE:

FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 20, REACH NUMBER 20.

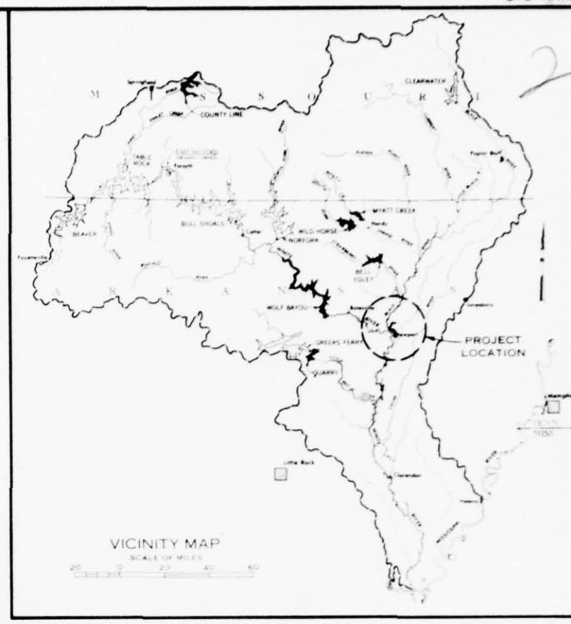
LEGEND:

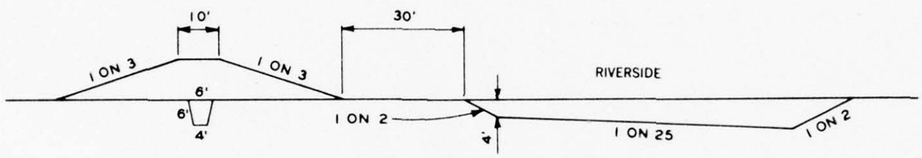
- PAVED ROAD
- GRAVEL ROAD
- PROJECT LEVEE
- EXISTING LEVEE

CULV.

RT LEVEE
T LEVEE

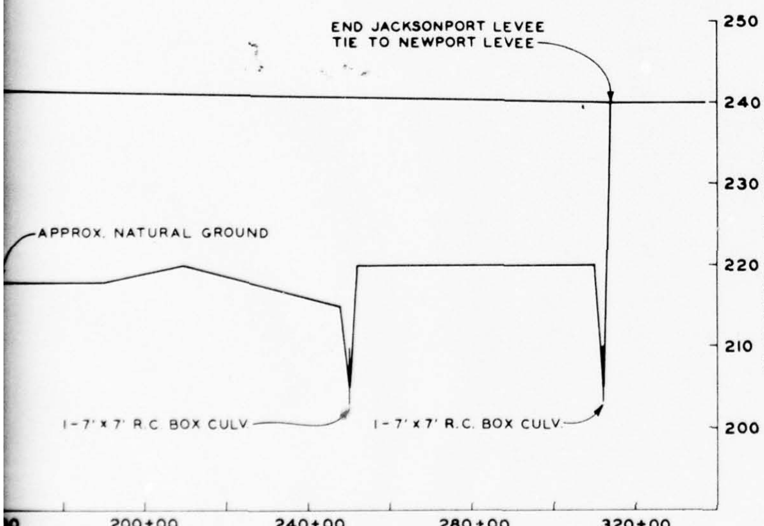
DISTRICT





TYPICAL SECTION

SCALE OF FEET
20' 0 20'



OFILE

WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

JACKSONPORT
LEVEE

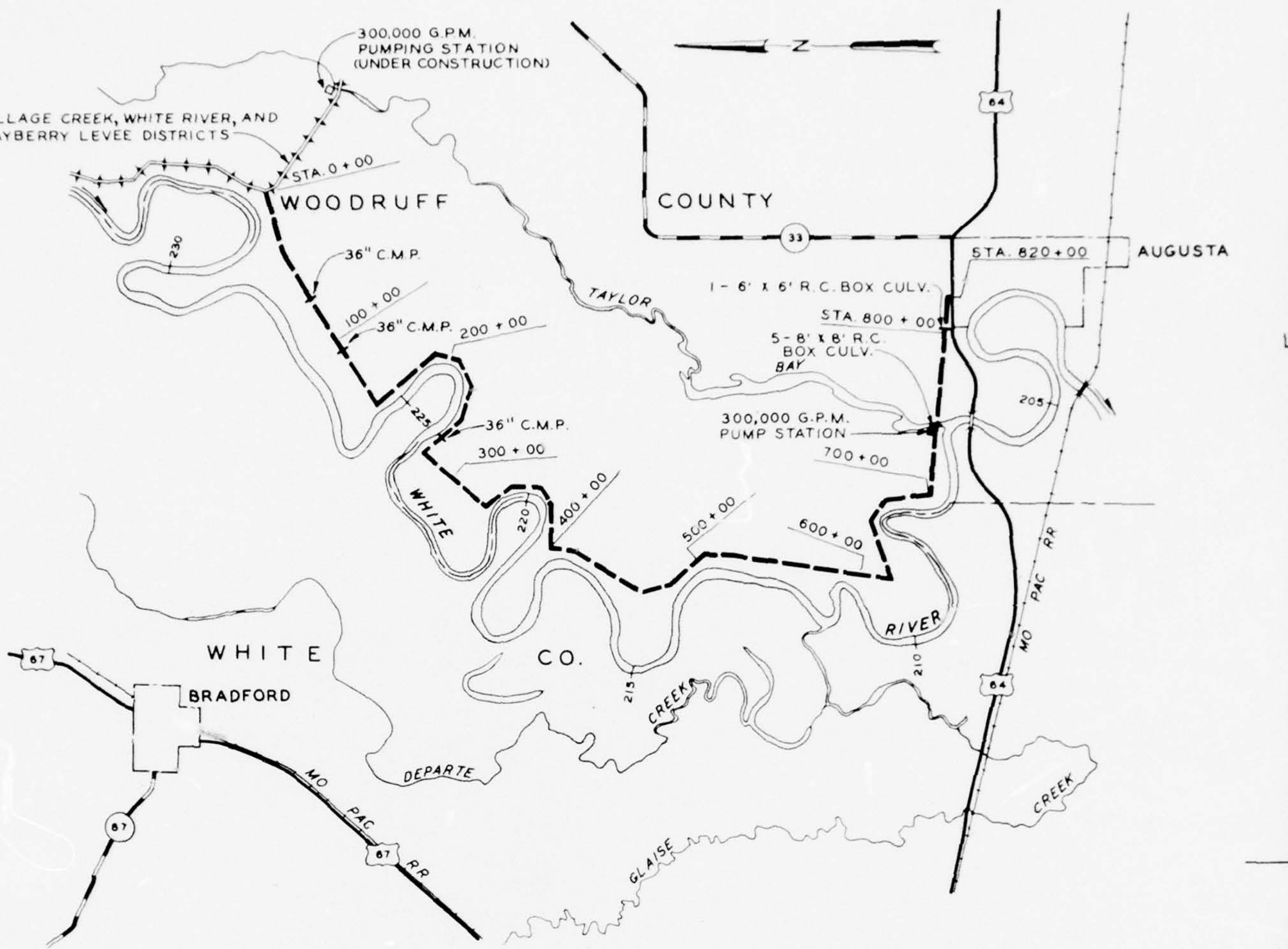
JACKSON COUNTY, ARK.

PLAN, PROFILE AND SECTION

SCALE AS SHOWN

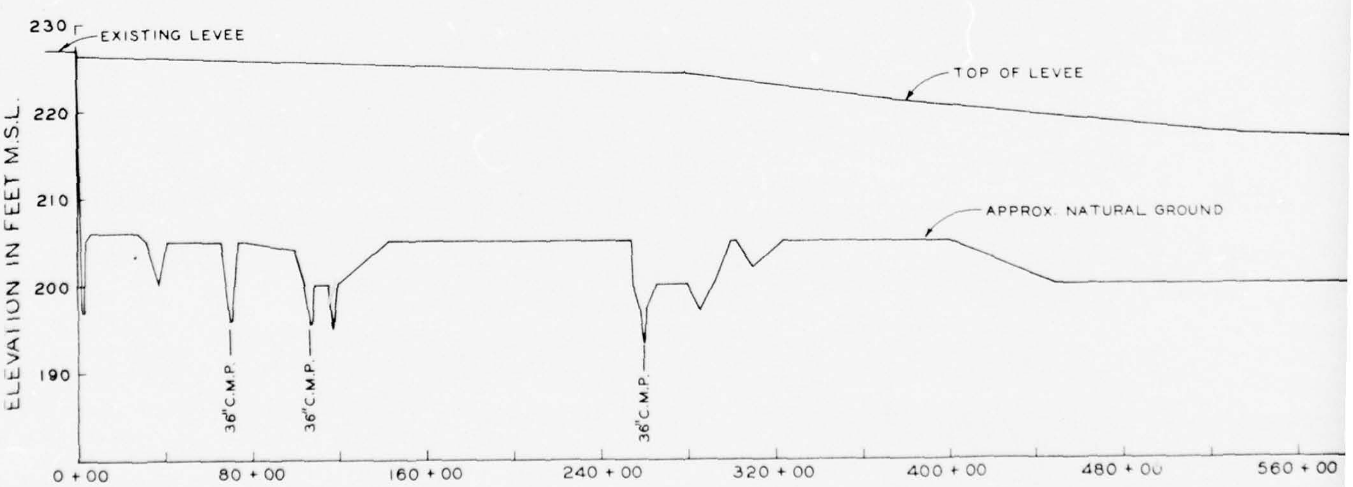
TO ACCOMPANY REPORT DATED JUNE 1968

PREPARED BY LITTLE ROCK DISTRICT CORPS OF ENGINEERS

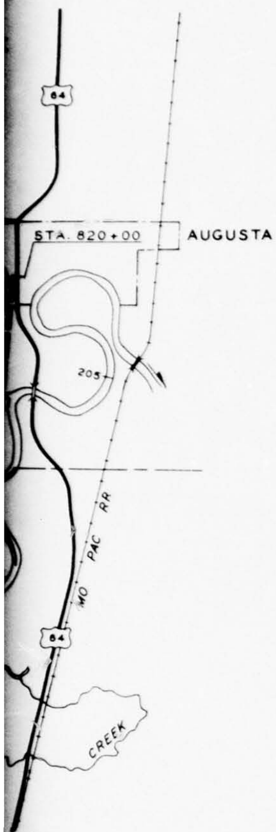


PLAN

SCALE OF MILES

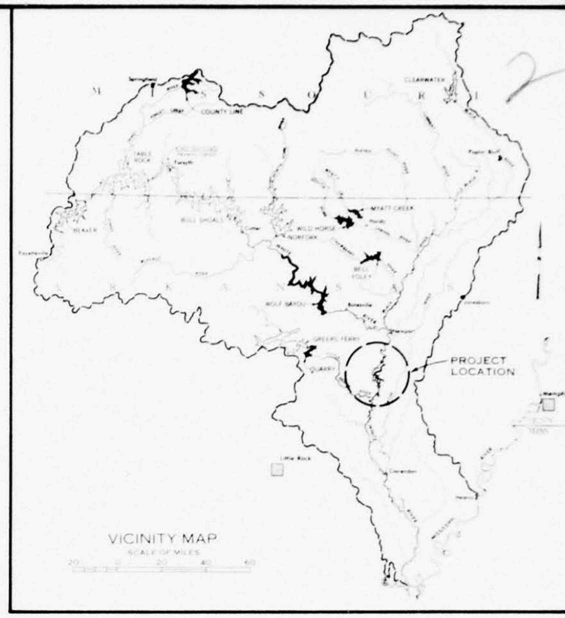


PROFILE



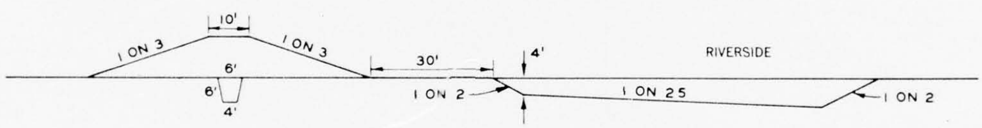
LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- PROJECT LEVEE
- EXISTING LEVEE



NOTE:

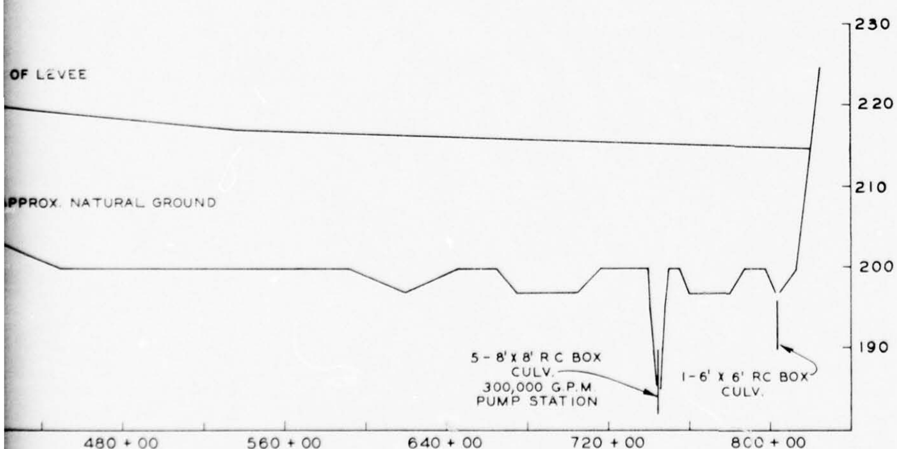
FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 91, REACH NUMBER 20.



TYPICAL SECTION

SCALE OF FEET

20' 0 20'



WHITE RIVER BASIN

MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

TAYLOR BAY TO AUGUSTA LEVEE

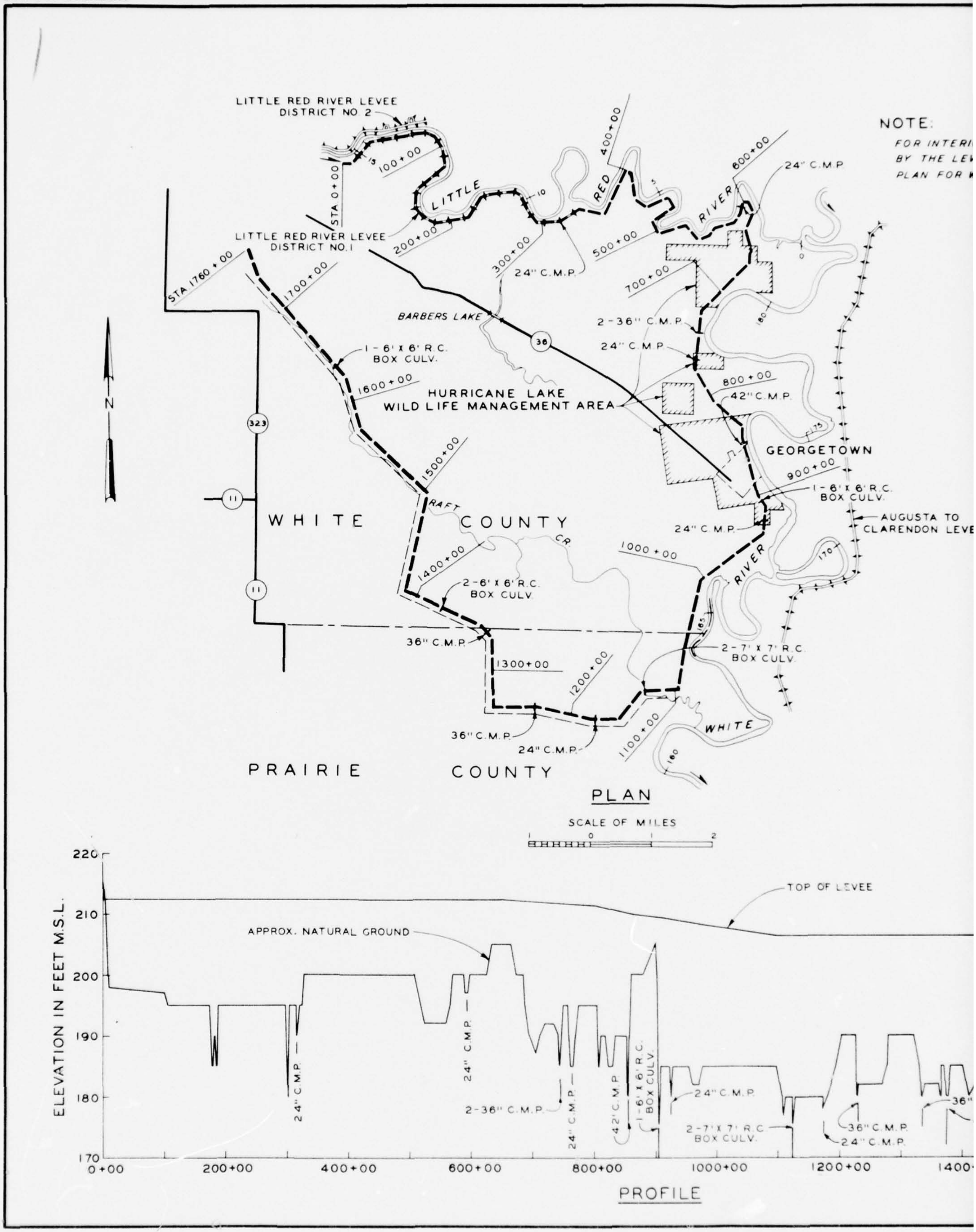
WOODRUFF COUNTY, ARKANSAS

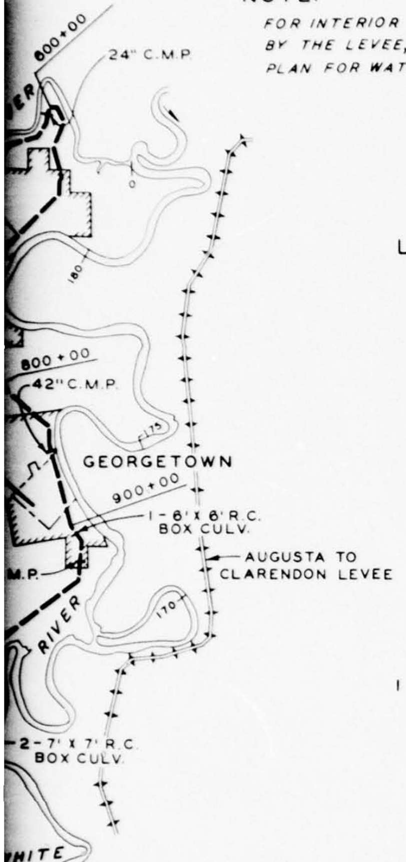
PLAN, PROFILE AND SECTION

SCALE AS SHOWN

TO ACCOMPANY REPORT DATED JUNE 1968

PREPARED BY LITTLE ROCK DISTRICT CORPS OF ENGINEERS


LITTLE RED RIVER LEVEE DISTRICT NO 2
LITTLE RED RIVER LEVEE DISTRICT NO.1
STA 0+00
100+00
200+00
300+00
400+00
500+00
600+00
700+00
800+00
900+00
1000+00
1100+00
1200+00
1300+00
1400+00
1500+00
1600+00
1700+00
STA 1760+00
LITTLE
RED
RIVER
24" C.M.P.
2-36" C.M.P.
42" C.M.P.
BARBERS LAKE
36
323
11
N
1-6' X 6' R.C. BOX CULV.
HURRICANE LAKE WILD LIFE MANAGEMENT AREA
GEORGETOWN
AUGUSTA TO CLARENDON LEVE
WHITE COUNTY
RAFT CR
2-6' X 6' R.C. BOX CULV.
36" C.M.P.
2-7' X 7' R.C. BOX CULV.
WHITE
PRAIRIE COUNTY
NOTE:
FOR INTERI
BY THE LEV
PLAN FOR W
PLAN
SCALE OF MILES
1 0 1 2
220
210
200
190
180
170
ELEVATION IN FEET M.S.L.
TOP OF LEVEE
APPROX. NATURAL GROUND
1-6' X 6' R.C. BOX CULV.
2-7' X 7' R.C. BOX CULV.
36" C.M.P.
0+00
200+00
400+00
600+00
800+00
1000+00
1200+00
1400
PROFILE

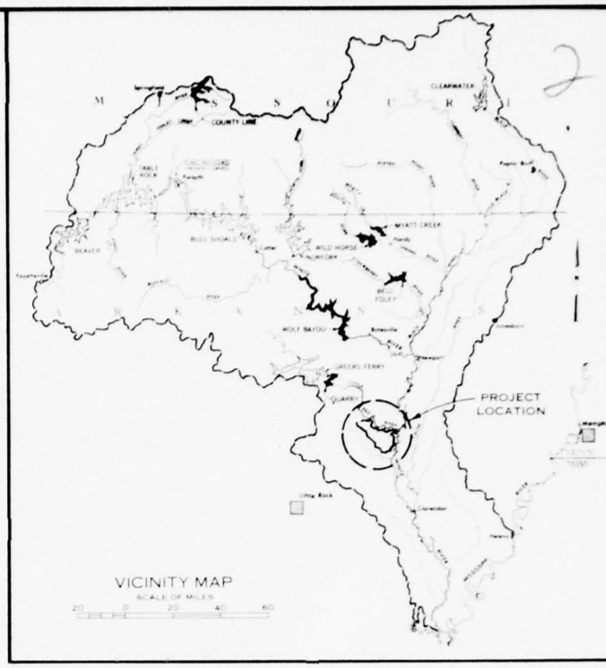


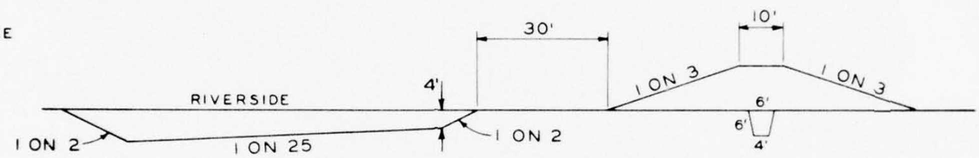
NOTE:

FOR INTERIOR DRAINAGE IN THE AREA PROTECTED BY THE LEVEE, SEE SOIL CONSERVATION SERVICE PLAN FOR WATERSHED NUMBER 93, REACH NUMBER 23.

LEGEND:

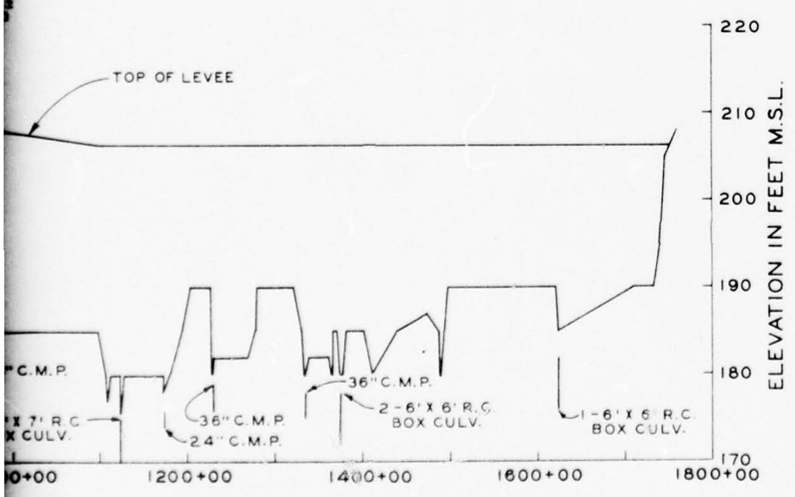
- *PAVED ROAD*
- *GRAVEL ROAD*
- *PROJECT LEVEE*
- *PROJECT CHANNEL IMPROVEMENT*
- *EXISTING LEVEE*





TYPICAL SECTION

SCALE OF FEET
20' 0 20'



WHITE RIVER BASIN
MISSOURI AND ARKANSAS

COMPREHENSIVE BASIN STUDY

LITTLE RED - WHITE RIVERS LEVEE

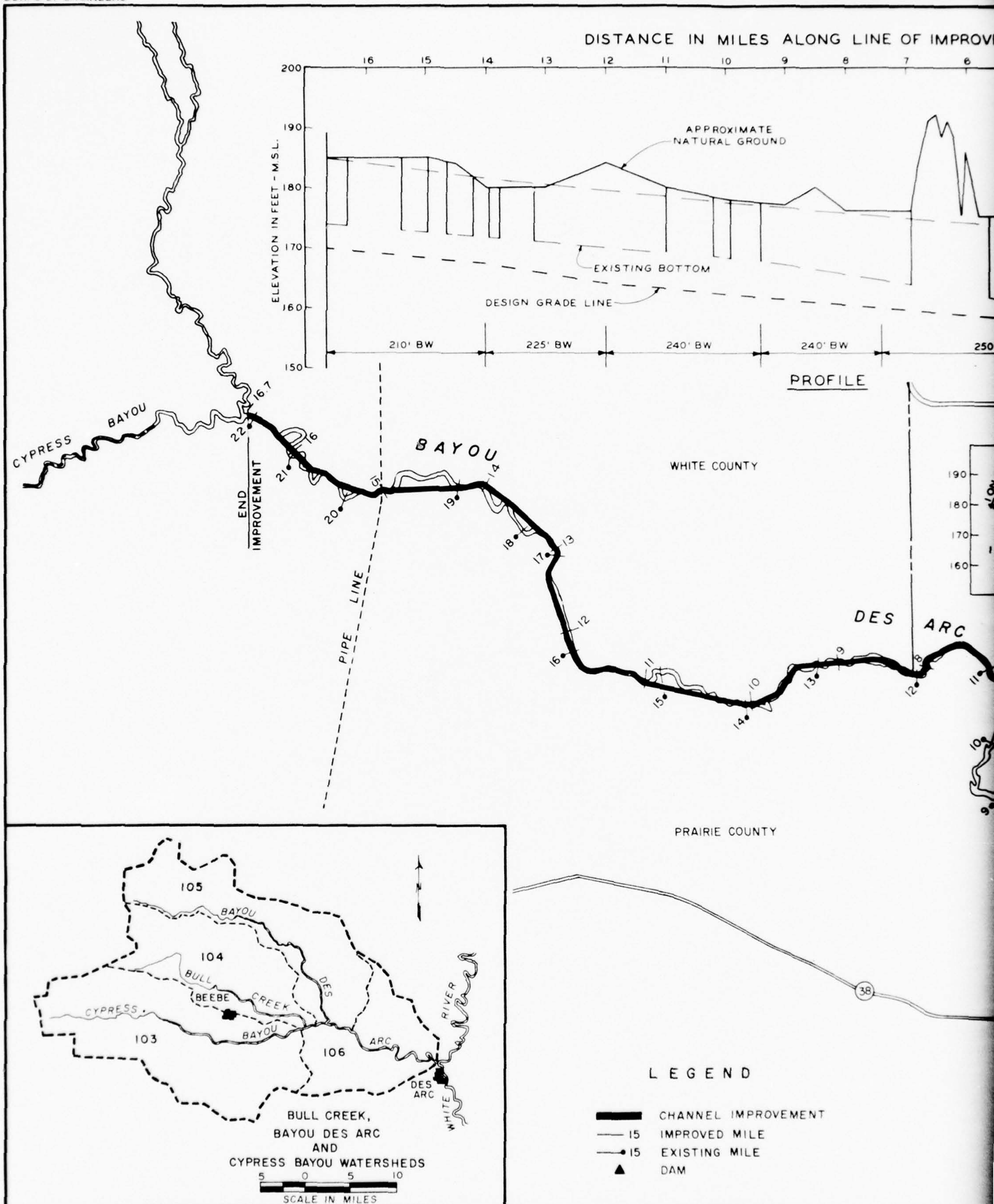
WHITE AND PRAIRIE COUNTIES, ARK.

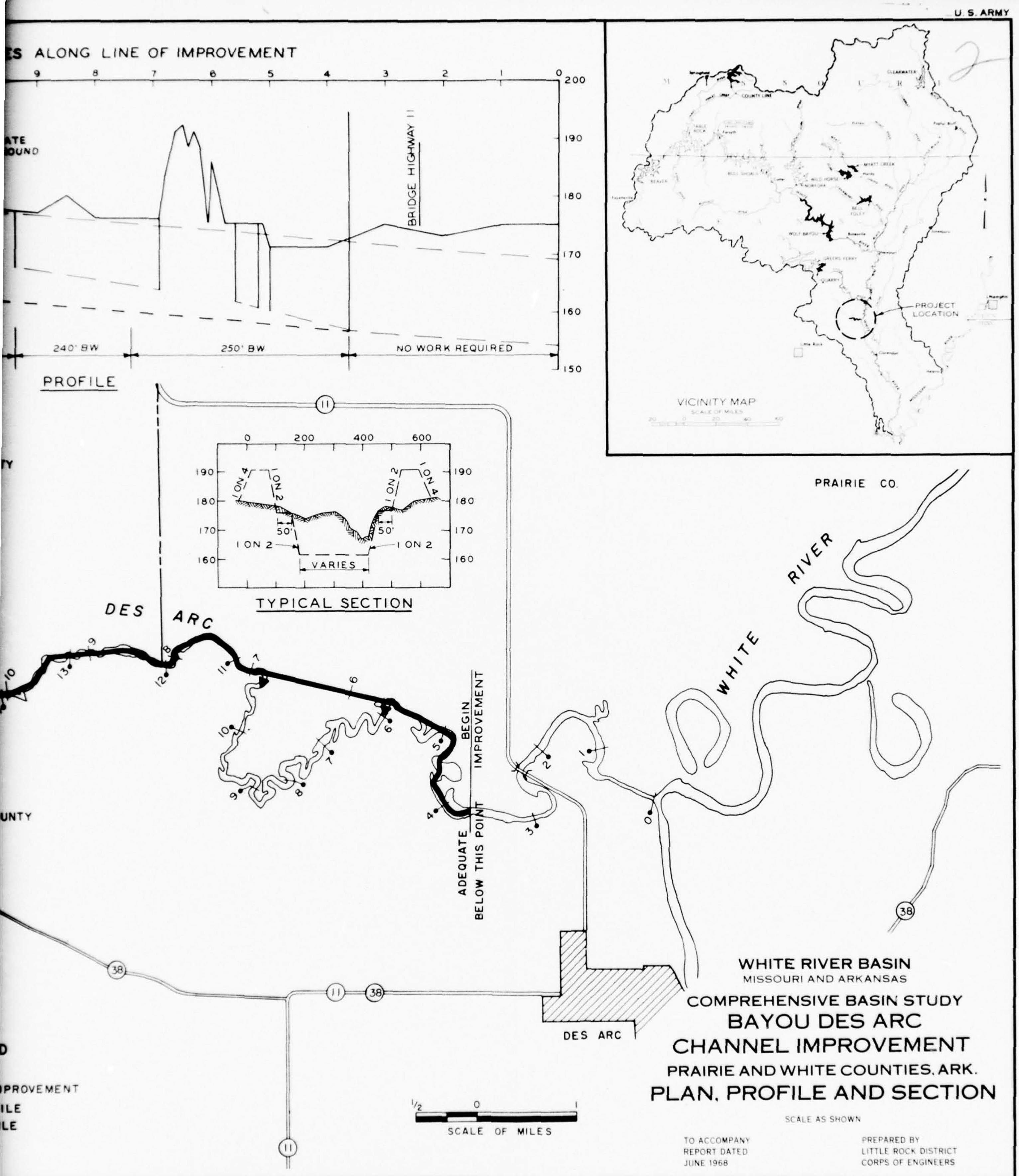
PLAN, PROFILE AND SECTION

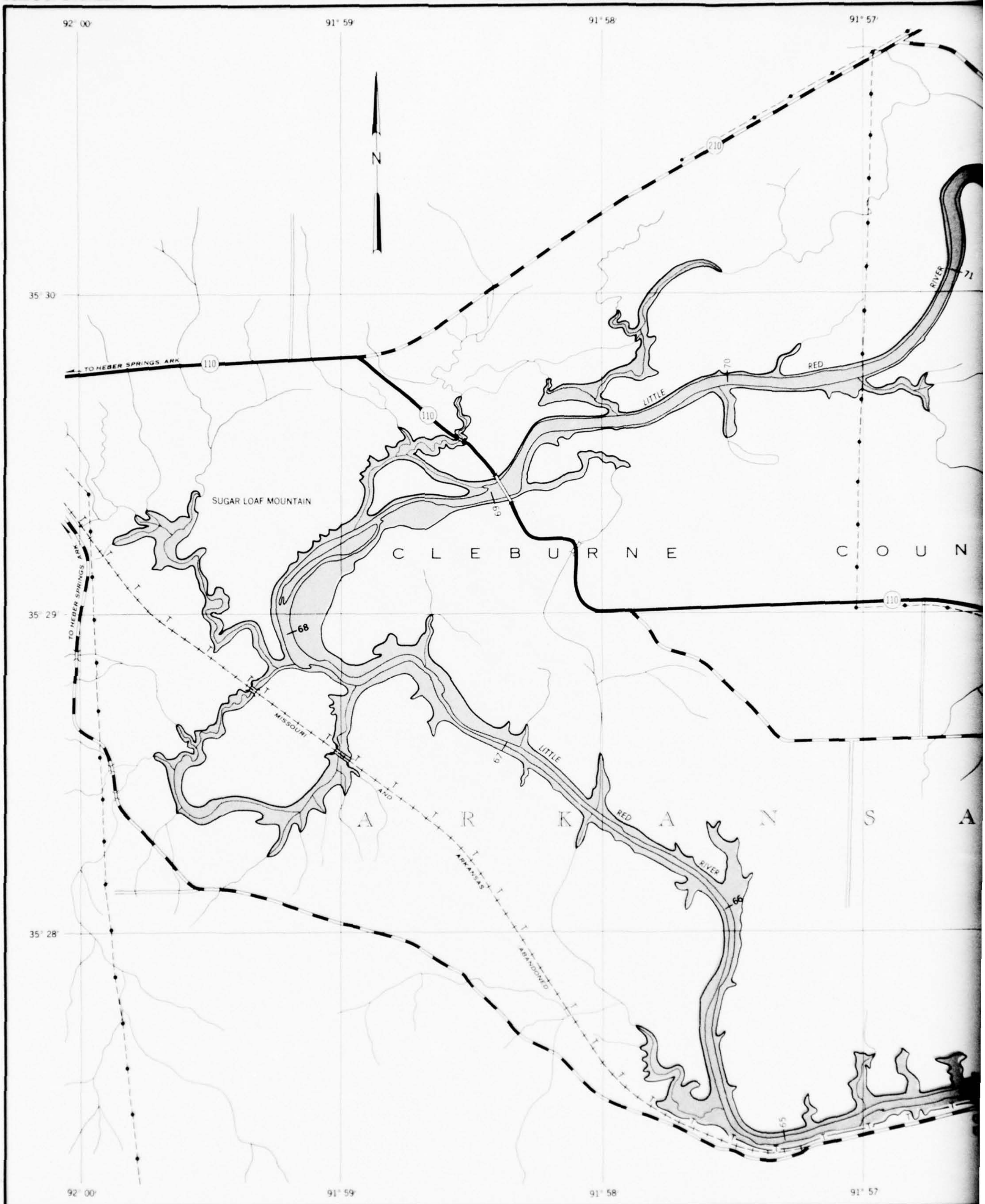
SCALE AS SHOWN

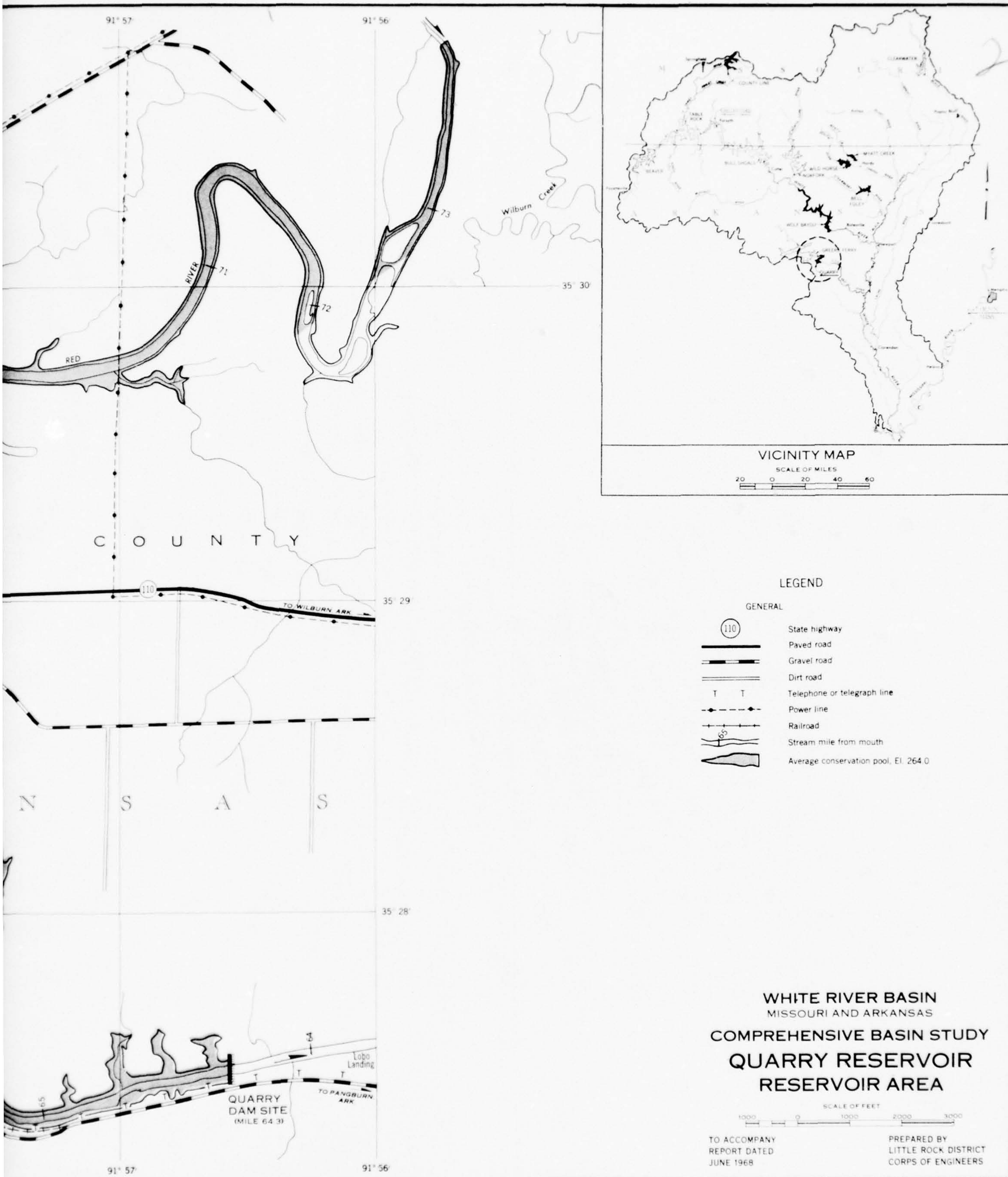
TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS


DISTANCE IN MILES ALONG LINE OF IMPROVE
ELEVATION IN FEET - M.S.L.
APPROXIMATE NATURAL GROUND
EXISTING BOTTOM
DESIGN GRADE LINE
210' BW
225' BW
240' BW
240' BW
250'
PROFILE
CYPRESS BAYOU
END IMPROVEMENT
PIPE LINE
BAYOU
DES ARC
WHITE COUNTY
PRAIRIE COUNTY
38
LEGEND
CHANNEL IMPROVEMENT
15 IMPROVED MILE
15 EXISTING MILE
DAM
105
104
103
106
BAYOU
BULL CREEK
BEEBE
CYPRESS
BAYOU
DES
ARC
RIVER
WHITE
DES ARC
BULL CREEK,
BAYOU DES ARC
AND
CYPRESS BAYOU WATERSHEDS
SCALE IN MILES


U.S. ARMY
ES ALONG LINE OF IMPROVEMENT
9 8 7 6 5 4 3 2 1 0
200
190
180
170
160
150
ATE
OUND
BRIDGE HIGHWAY 11
240' BW
250' BW
NO WORK REQUIRED
PROFILE
0 200 400 600
190
180
170
160
1 ON 4
1 ON 2
50'
VARIES
TYPICAL SECTION
DES ARC
BEGIN IMPROVEMENT
ADEQUATE BELOW THIS POINT
WHITE RIVER
PRAIRIE CO.
TY
UNTY
D
IPROVEMENT
ILE
LE
PROJECT LOCATION
VICINITY MAP
DES ARC
11
38
1/2 0 1
SCALE OF MILES
WHITE RIVER BASIN
MISSOURI AND ARKANSAS
COMPREHENSIVE BASIN STUDY
BAYOU DES ARC
CHANNEL IMPROVEMENT
PRAIRIE AND WHITE COUNTIES, ARK.
PLAN, PROFILE AND SECTION
SCALE AS SHOWN
TO ACCOMPANY
REPORT DATED
JUNE 1968
PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS


92° 00'
91° 59'
91° 58'
91° 57'
N
210
35° 30'
TO HEBER SPRINGS ARK
110
110
SUGAR LOAF MOUNTAIN
LITTLE
RED
RIVER
71
70
69
68
67
66
65
C L E B U R N E C O U N
35° 29'
TO HEBER SPRINGS ARK
MISSOURI
AND
ARKANSAS
ABANDONED
A R K A N S A
35° 28'
92° 00'
91° 59'
91° 58'
91° 57'



LEGEND

GENERAL

(110)	State highway
	Paved road
	Gravel road
	Dirt road
T T	Telephone or telegraph line
	Power line
	Railroad
65	Stream mile from mouth
	Average conservation pool, El. 264.0

WHITE RIVER BASIN
MISSOURI AND ARKANSAS

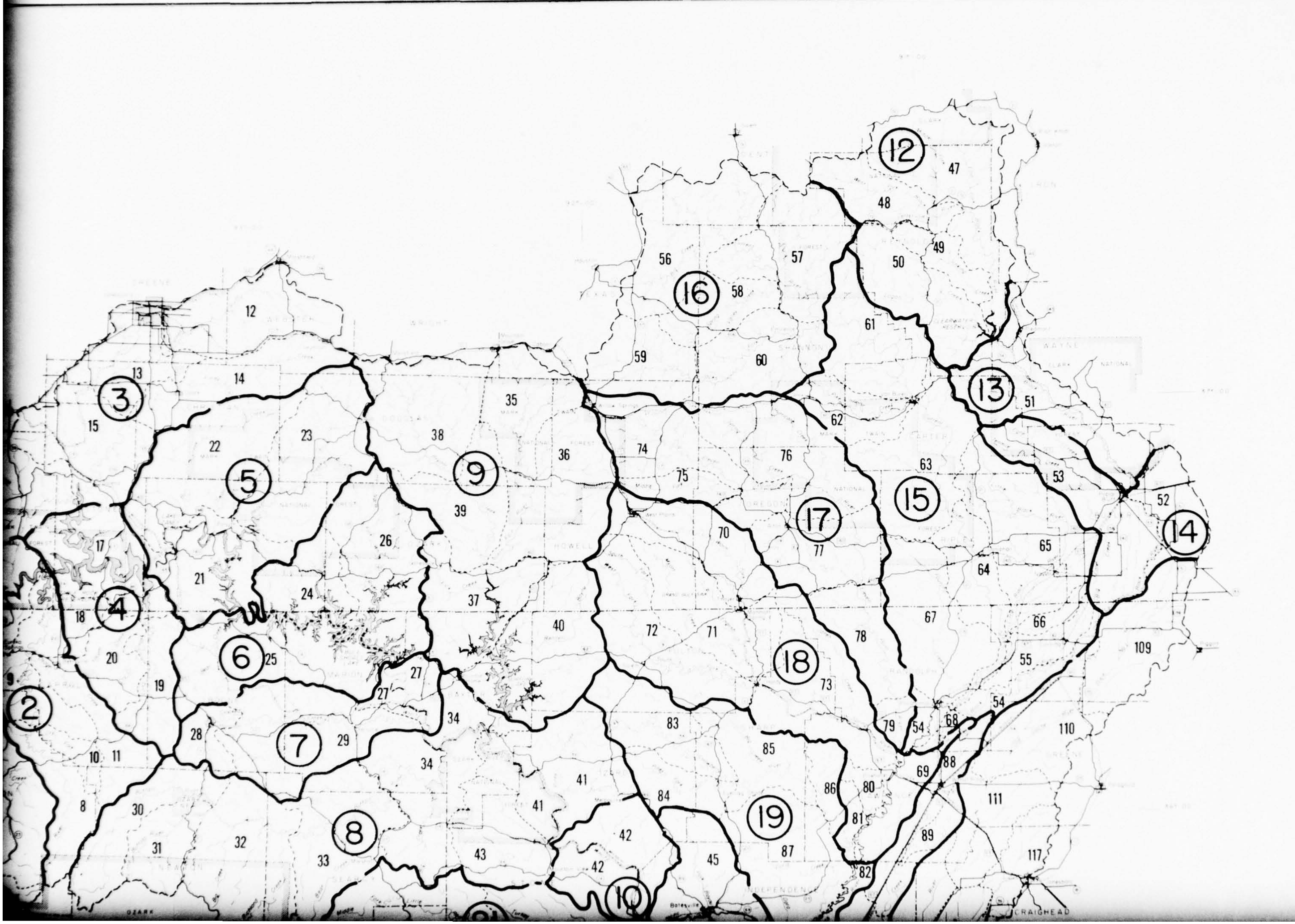
COMPREHENSIVE BASIN STUDY

QUARRY RESERVOIR
RESERVOIR AREA

SCALE OF FEET
1000 0 1000 2000 3000

TO ACCOMPANY
REPORT DATED
JUNE 1968

PREPARED BY
LITTLE ROCK DISTRICT
CORPS OF ENGINEERS



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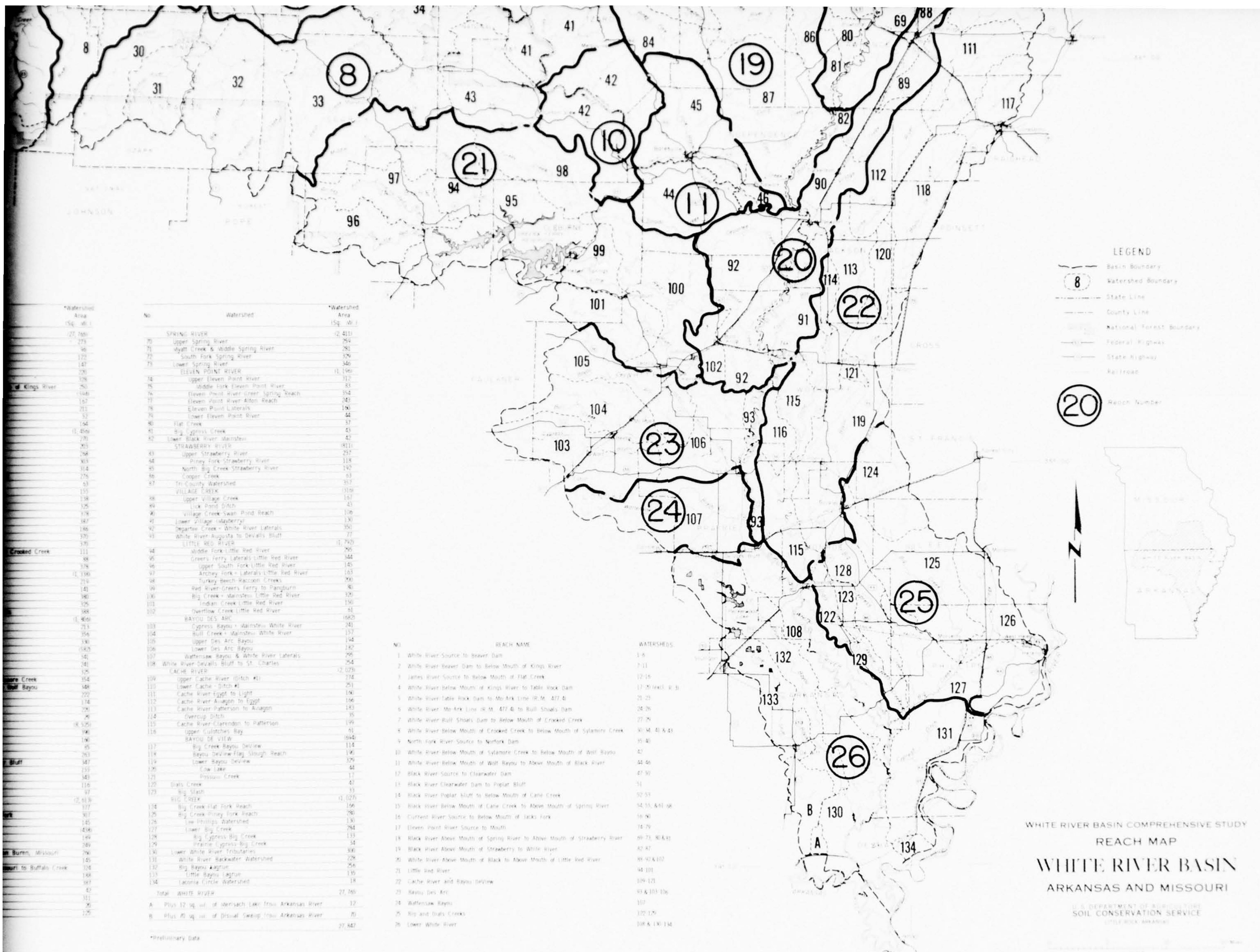
19
CRAIGHEAD



No	Watershed	*Watershed Area (Sq. Mi.)
	SPRING RIVER	(2,411)
70	Upper Spring River	259
71	Myatt Creek & Middle Spring River	281
72	South Fork Spring River	329
73	Lower Spring River	346
	ELEVEN POINT RIVER	(1,196)
74	Upper Eleven Point River	312
75	Middle Fork Eleven Point River	83
76	Eleven Point River Greer Spring Reach	354
77	Eleven Point River Alton Reach	243
78	Eleven Point Laterals	160
79	Lower Eleven Point River	44
80	Flat Creek	37
81	Big Cypress Creek	43
82	Lower Black River Mainstem	42
	STRAWBERRY RIVER	(811)
83	Upper Strawberry River	237
84	Piney Fork Strawberry River	118
85	North Big Creek Strawberry River	192
86	Cooper Creek	63
87	Tri-County Watershed	357
	VILLAGE CREEK	(310)
88	Upper Village Creek	167
89	Lick Pond Ditch	43
90	Village Creek Swan Pond Reach	106
91	Lower Village (Mayberry)	130
92	Departee Creek - White River Laterals	350
93	White River Augusta to DeValls Bluff	77
	LITTLE RED RIVER	(1,792)
94	Middle Fork Little Red River	295
95	Greers Ferry Laterals Little Red River	344
96	Upper South Fork Little Red River	145
97	Archey Fork - Laterals Little Red River	163
98	Turkey Beech-Raccoon Creeks	200
99	Red River-Greers Ferry to Pangburn	80
100	Big Creek - Mainstem Little Red River	320
101	Indian Creek Little Red River	150
102	Overflow Creek Little Red River	61
	BAYOU DES ARC	(682)
103	Cypress Bayou - Mainstem White River	241
104	Bull Creek - Mainstem White River	157
105	Upper Des Arc Bayou	194
106	Lower Des Arc Bayou	182
107	Wattensaw Bayou & White River Laterals	295
108	White River DeValls Bluff to St. Charles	254
	CACHE RIVER	(2,073)
109	Upper Cache River (Ditch #1)	274
110	Lower Cache - Ditch #1	251
111	Cache River Egypt to Light	160
112	Cache River Anagon to Egypt	166
113	Cache River Patterson to Anagon	183
114	Overcup Ditch	35
115	Cache River Clarendon to Patterson	199
116	Upper Culotches Bay	61
	BAYOU DE VIEW	(694)
117	Big Creek Bayou DeView	114
118	Bayou DeView Flag Slough Reach	190
119	Lower Bayou DeView	329
120	Cow Lake	44
121	Possum Creek	17
122	Dials Creek	47
123	Big Slash	33
	BIG CREEK	(1,027)
124	Big Creek Flat Fork Reach	166
125	Big Creek Piney Fork Reach	280
126	Lee Phillips Watershed	130
127	Lower Big Creek	284
128	Big Cypress Big Creek	133
129	Prairie Cypress Big Creek	34
130	Lower White River Tributaries	300
131	White River Backwater Watershed	228
132	Big Bayou Lagrue	256
133	Little Bayou Lagrue	135
134	Laconia Circle Watershed	18
	Total WHITE RIVER	27,765
A	Plus 12 sq. mi. of Merisach Lake from Arkansas River	12
B	Plus 70 sq. mi. of Dismal Swamp from Arkansas River	70
		27,847

*Preliminary Data

NO	REACH NAME	WATERSHEDS
1	White River Source to Beaver Dam	1-6
2	White River Beaver Dam to Below Mouth of Kings River	7-11
3	James River Source to Below Mouth of Flat Creek	12-16
4	White River Below Mouth of Kings River to Table Rock Dam	17-20 (excl. R. 3)
5	White River Table Rock Dam to Mo-Ark Line (R.M. 477.4)	21-23
6	White River Mo-Ark Line (R.M. 477.4) to Bull Shoals Dam	24-26
7	White River Bull Shoals Dam to Below Mouth of Crooked Creek	27-29
8	White River Below Mouth of Crooked Creek to Below Mouth of Sylamore Creek	30-34, 41 & 43
9	North Fork River Source to Norfork Dam	35-40
10	White River Below Mouth of Sylamore Creek to Below Mouth of Wolf Bayou	42
11	White River Below Mouth of Wolf Bayou to Above Mouth of Black River	44-46
12	Black River Source to Clearwater Dam	47-50
13	Black River Clearwater Dam to Poplar Bluff	51
14	Black River Poplar Bluff to Below Mouth of Cane Creek	52-53
15	Black River Below Mouth of Cane Creek to Above Mouth of Spring River	54, 55, & 61-68
16	Current River Source to Below Mouth of Jacks Fork	56-60
17	Eleven Point River Source to Mouth	74-79
18	Black River Above Mouth of Spring River to Above Mouth of Strawberry River	69-73, 80 & 81
19	Black River Above Mouth of Strawberry to White River	82-87
20	White River Above Mouth of Black to Above Mouth of Little Red River	88-92 & 102
21	Little Red River	94-101
22	Cache River and Bayou DeView	109-121
23	Bayou Des Arc	93 & 103-106
24	Wattensaw Bayou	107
25	Big and Dials Creeks	122-129
26	Lower White River	108 & 130-134

WHITE RIVER BASIN COMPREHENSIVE STUDY

REACH MAP

WHITE RIVER BASIN

ARKANSAS AND MISSOURI

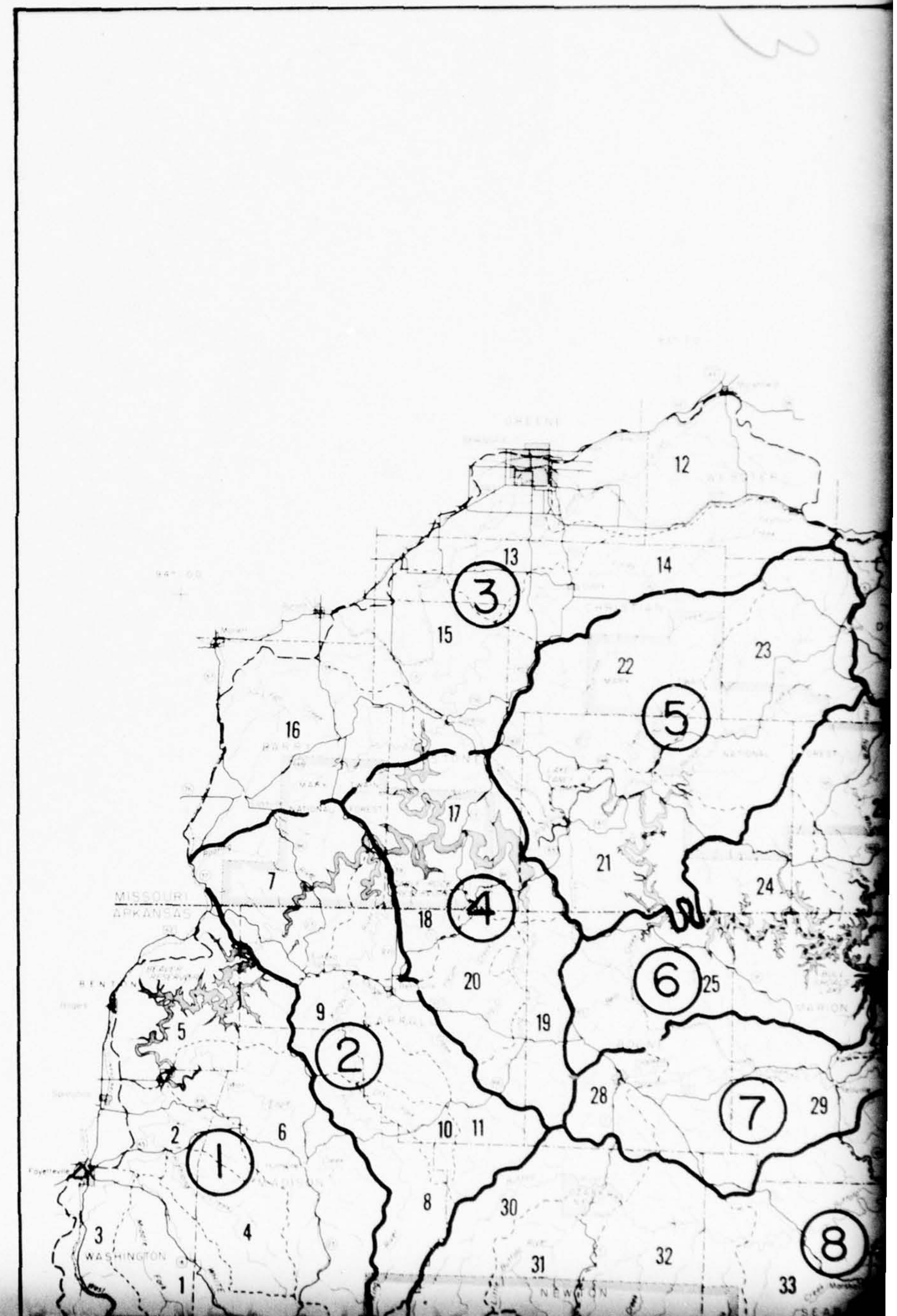
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

January, 1966 Rev. 3-68 4-R-20955

Rev. 10/65 Rev. 10/66 Base 4-R-19905

PLATE No. P-20

3



MISSOURI
ARKANSAS
WASHINGTON
NEWTON
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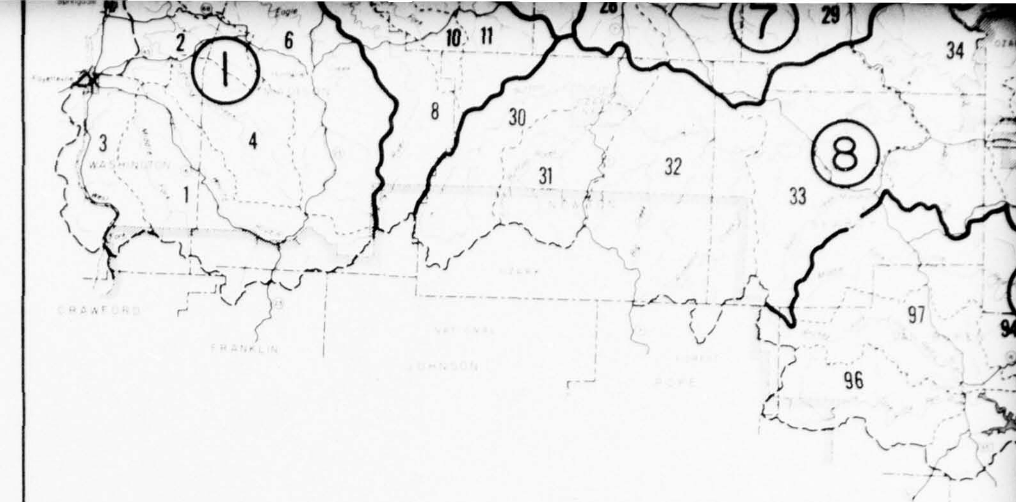


No.	Watershed	*Watershed Area (Sq. Mi.)
	WHITE RIVER	(27,765)
1	Upper White River	273
2	White River-Brush Creek Reach	96
3	West Fork of White River	122
4	Richland Creek	147
5	Beaver Dam Laterals	220
6	War Eagle Creek	328
7	White River-Beaver Dam to below Mouth of Kings River	250
	KINGS RIVER	(594)
8	Upper Kings River	167
9	Lower Kings River	211
10	Dry Fork Kings River	52
11	Osage Creek	164
	JAMES RIVER	(1,456)
12	Upper James River	270
13	Middle James River	203
14	Finley Creek	268
15	Lower James River	303
16	Flat Creek	314
17	Table Rock Laterals (excl. James River)	276
18	Indian Creek	63
19	Long Creek	155
20	Yokum-Dry Creeks	138
21	Taneycomo Laterals	325
22	Bull-Swan Creeks	378
23	Beaver Creek	387
24	Upper Bull Shoals Laterals	186
25	Lower Bull Shoals Laterals	370
26	Little North Fork Laterals	370
27	White River-Bull Shoals Dam to below Crooked Creek	111
28	Upper Crooked Creek	88
29	Lower Crooked Creek	378
	BUFFALO RIVER	(1,338)
30	Big Buffalo River	219
31	Little Buffalo River	141
32	Big-Richland Creeks	380
33	Middle Buffalo River	325
34	Lower Buffalo & White River Lateral	388
	NORTH FORK RIVER (AT DAM)	(1,806)
35	Upper North Fork River	213
36	Lower North Fork River	356
37	Upper Norfork Dam Tributaries	330
	BRYANT CREEK	(582)
38	Upper Bryant Creek	341
39	Lower Bryant Creek	241
40	Lower Norfork Dam Tributaries	325
41	White River-North Fork River to Sylamore Creek	354
42	White River-Sylamore Creek to below Wolf Bayou	348
43	Sylamore Creek	222
44	Salado Creek + Mainstem Laterals	174
45	Polk Bayou + Mainstem Laterals	220
46	Mud Creek	79
	BLACK RIVER	(8,575)
47	Upper Black & Clearwater Laterals	390
48	West Fork of Black River	160
49	Sinking Creek	85
50	Logan Creek	263
51	Black River-Clearwater Dam to Poplar Bluff	347
52	North Inter-River Drainage District	155
53	Cane Creek + Black River Mainstem	343
54	Black River-Pocahontas Reach	116
55	Corning Ditches	97
	CURRENT RIVER	(2,619)
56	Upper Current River	377
57	Current River-Akers to Jacks Fork	407
58	Spring Valley Creek	145
	JACKS FORK CREEK	(430)
59	Upper Jacks Fork	186
60	Lower Jacks Fork	245
61	Current River-Jacks Fork to Van Buren, Missouri	78
62	Pike Creek	145
63	Current River-Van Buren, Missouri to Buffalo Creek	328
64	Lower Current River	188
65	Little Black River	187
66	Black Creek	87
67	Fourche Creek	151
68	Little Running Water Ditch	96
69	Big Running Water Ditch	125

No.	Watershed	*Watershed Area (Sq. Mi.)
	SPRING RIVER	(2,411)
70	Upper Spring River	759
71	Myatt Creek & Middle Spring River	291
72	South Fork Spring River	325
73	Lower Spring River	541
	ELEVEN POINT RIVER	(1,190)
74	Upper Eleven Point River	312
75	Middle Fork Eleven Point River	83
76	Eleven Point River-Greer Spring Reach	354
77	Eleven Point River-Alton Reach	243
78	Eleven Point Laterals	180
79	Lower Eleven Point River	44
80	Flat Creek	37
81	Big Cypress Creek	41
82	Lower Black River Mainstem	42
	STRAWBERRY RIVER	(811)
83	Upper Strawberry River	257
84	Piney Fork Strawberry River	118
85	North Big Creek Strawberry River	192
86	Cooper Creek	61
87	Tri-County Watershed	357
	VILLAGE CREEK	(318)
88	Upper Village Creek	117
89	Lick Pond Ditch	43
90	Village Creek-Swan Pond Reach	136
91	Lower Village (Mayberry)	138
92	Departee Creek + White River Laterals	350
93	White River-Augusta to Devalls Bluff	77
	LITTLE RED RIVER	(1,795)
94	Middle Fork Little Red River	295
95	Greers Ferry Laterals-Little Red River	544
96	Upper South Fork Little Red River	145
97	Archey Fork + Laterals-Little Red River	163
98	Turkey-Beech-Raccoon Creeks	206
99	Red River-Greers Ferry to Pangburn	80
100	Big Creek + Mainstem Little Red River	320
101	Indian Creek-Little Red River	150
102	Overflow Creek-Little Red River	61
	BAYOU DES ARC	(682)
103	Cypress Bayou + Mainstem White River	241
104	Bull Creek + Mainstem White River	157
105	Upper Des Arc Bayou	144
106	Lower Des Arc Bayou	140
107	Wattensaw Bayou & White River Laterals	295
108	White River-Devalls Bluff to St. Charles	254
	CACHE RIVER	(2,029)
109	Upper Cache River (Ditch #1)	274
110	Lower Cache (Ditch #1)	251
111	Cache River-Egypt to Light	186
112	Cache River-Augon to Egypt	186
113	Cache River-Patterson to Augon	183
114	Overcup Ditch	95
115	Cache River-Clarendon to Patterson	199
116	Upper Cutoff-Jones Bay	61
	BAYOU DE VIEW	(644)
117	Big Creek-Bayou Deview	114
118	Bayou Deview-Big Slough Reach	190
119	Lower Bayou Deview	129
120	Cow Lake	44
121	Possum Creek	17
122	Dials Creek	47
123	Big Slash	33
	BIG CREEK	(1,025)
124	Big Creek-Flat Fork Reach	156
125	Big Creek-Piney Fork Reach	98
126	Lee-Phillips Watershed	130
127	Lower Big Creek	264
128	Big Cypress-Big Creek	133
129	Prairie Cypress-Big Creek	32
130	Lower White River Tributaries	400
131	White River Backwater Watershed	276
132	Big Bayou LaGrue	258
133	Little Bayou LaGrue	136
134	Lacona Circle Watershed	18
	Total: WHITE RIVER	27,765
A	Plus 17 sq. mi. of [illegible] Lake from Arkansas River	17
B	Plus 75 sq. mi. of [illegible] Swamp from Arkansas River	75
		27,857

*Preliminary Data

BASE MAP COMPILED FROM [illegible] [illegible]

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE LITTLE ROCK, ARKANSAS

[illegible]

4

1

UPPER WHITE RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	2432	11	7328	21	1664
2	2176	12	3840	22	3648
3	1760	13	8384	23	6528
4	2560	14	4992	24	1344
5	2624	15	3072	25	2176
6	5888	16	1728	26	2432
7	3200	17	2240	27	3008
8	7488	18	1280	28	1344
9	3040	19	1216	29	2944
10	2048	20	1280	30	3072
				31	2560

3

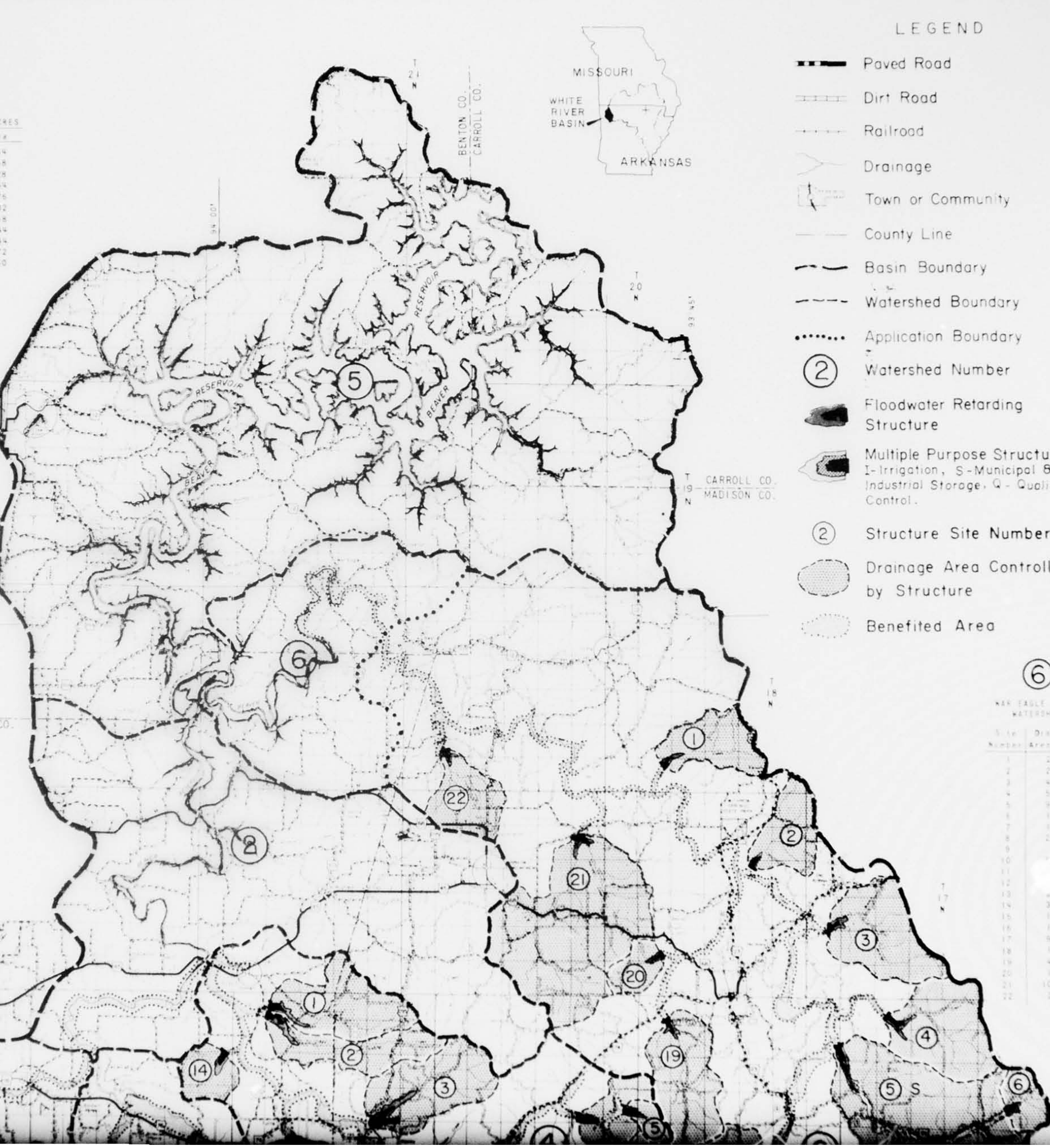
WEST FORK WHITE RIVER WATERSHED

Site Number	Drainage Area-Acres
1	1,056
2	1,344
3	1,664
4	3,264
5	1,920
6	4,544
7	2,112
8	3,072
9	1,216
10	832
11	2,880
12	9,216
13	2,816
14	704

4

RICHLAND CREEK WATERSHED

Site Number	Drainage Area-Acres
1	4,160
2	3,072
3	4,736
4	2,496
5	1,024
6	1,472
7	2,112
8	1,664
9	2,112
10	22,464
11	2,432
12	3,904
13	2,560
14	1,280



LEGEND

Paved Road

Dirt Road

Railroad

Drainage

Town or Community

County Line

Basin Boundary

Watershed Boundary

Application Boundary

(2) Watershed Number

Floodwater Retarding Structure

Multiple Purpose Structure I-Irrigation, S-Municipal & Industrial Storage, Q-Quality Control.

(2) Structure Site Number

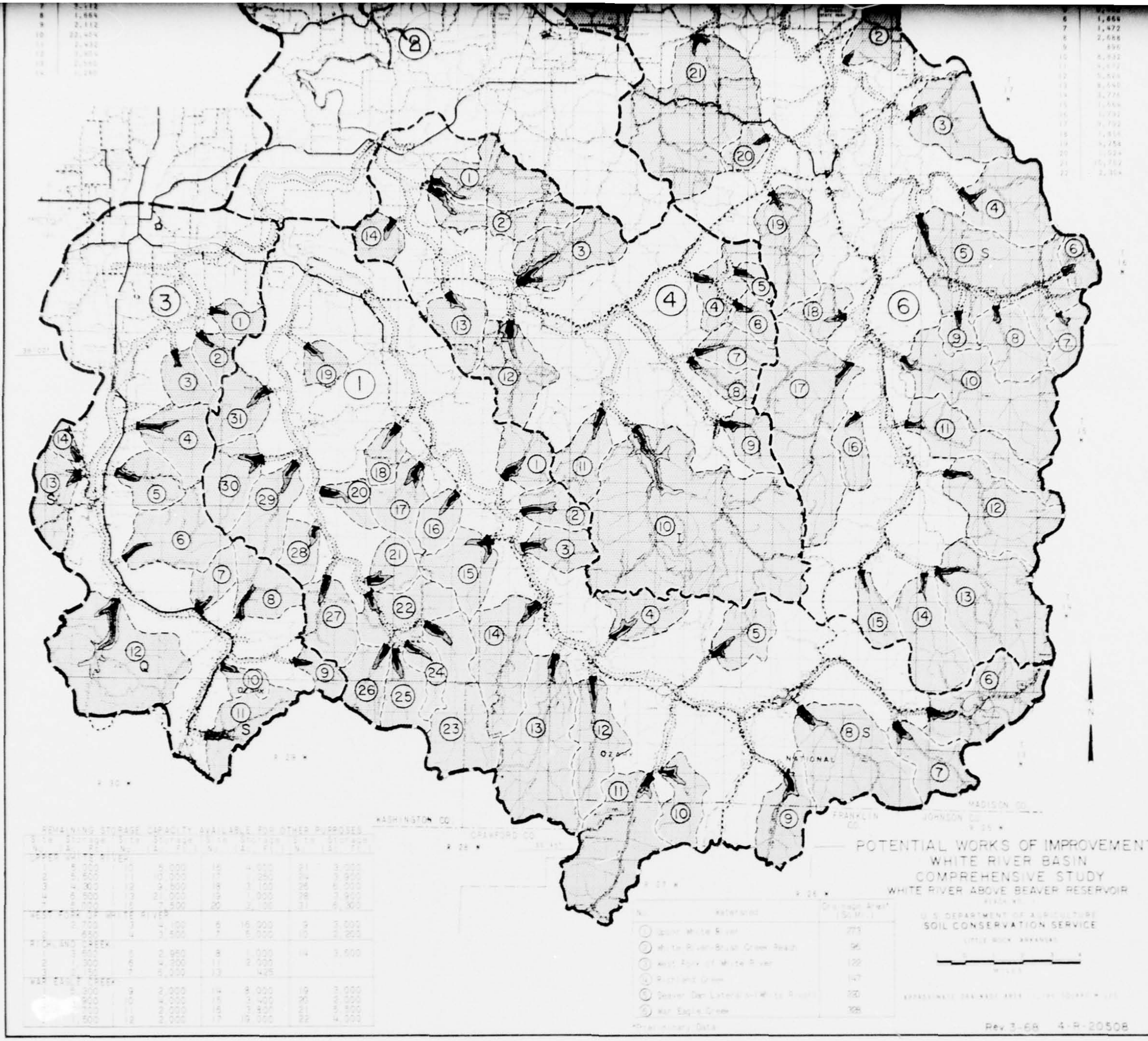
Drainage Area Controlled by Structure

Benefited Area

6

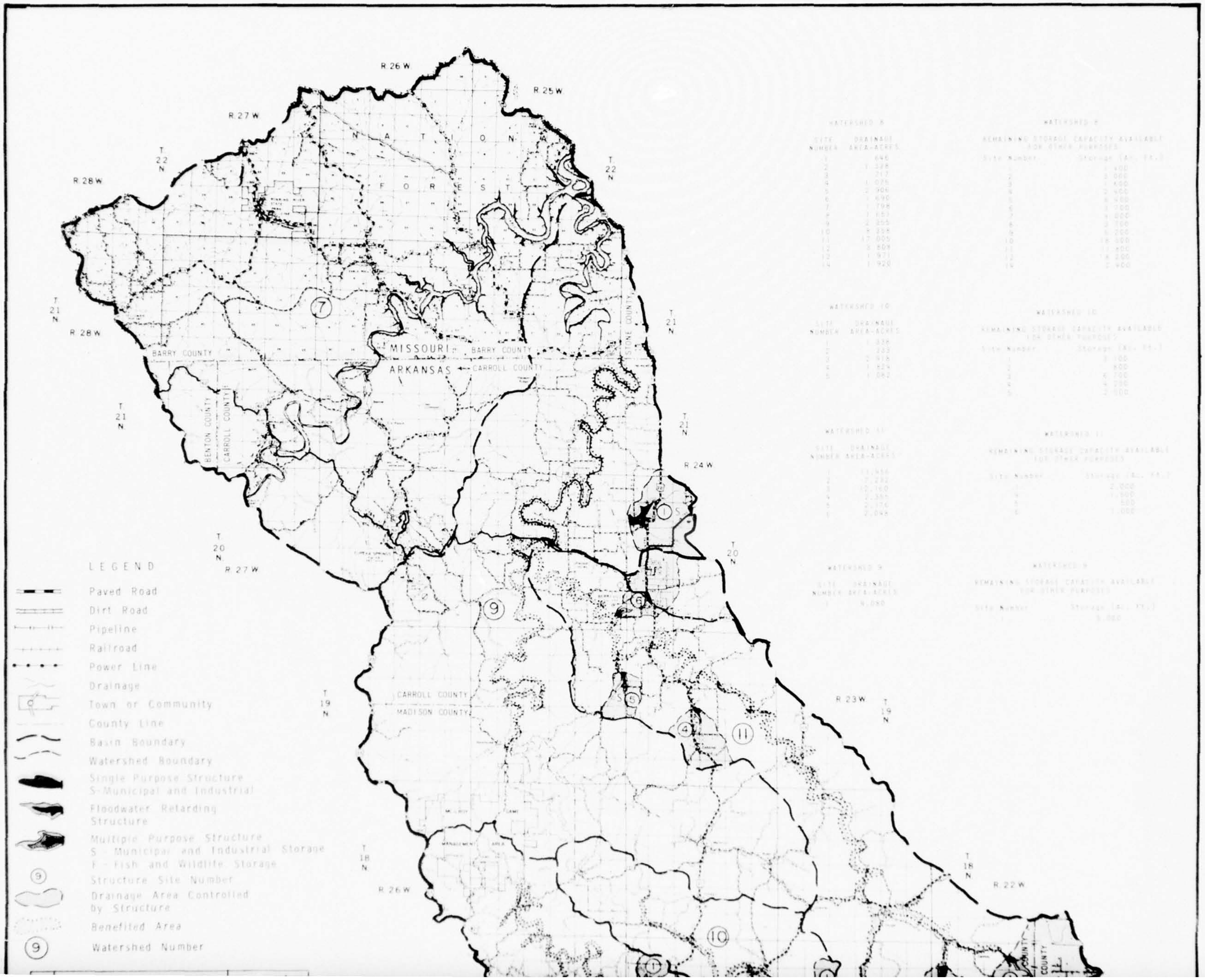
WAR EAGLE CREEK WATERSHED

Site Number	Drainage Area-Acres
1	2,688
2	2,496
3	4,672
4	5,440
5	5,408
6	1,664
7	1,472
8	2,688
9	896
10	[illegible]
11	[illegible]
12	[illegible]
13	4,640
14	3,776
15	1,664
16	1,792
17	6,792
18	1,856
19	4,288
20	1,024
21	10,752
22	2,304



POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
WHITE RIVER ABOVE BEAVER RESERVOIR
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Upper White River 273
White River-Brush Creek Reach 96
West Fork of White River 122
Richland Creek 147
Beaver Dam Laterals-White River 280
War Eagle Creek 308
Rev. 3-68 4-R-20508
WASHINGTON CO.
CRAWFORD CO.
FRANKLIN CO.
JOHNSON CO.
MADISON CO.
NATIONAL

PLATE No. P-21

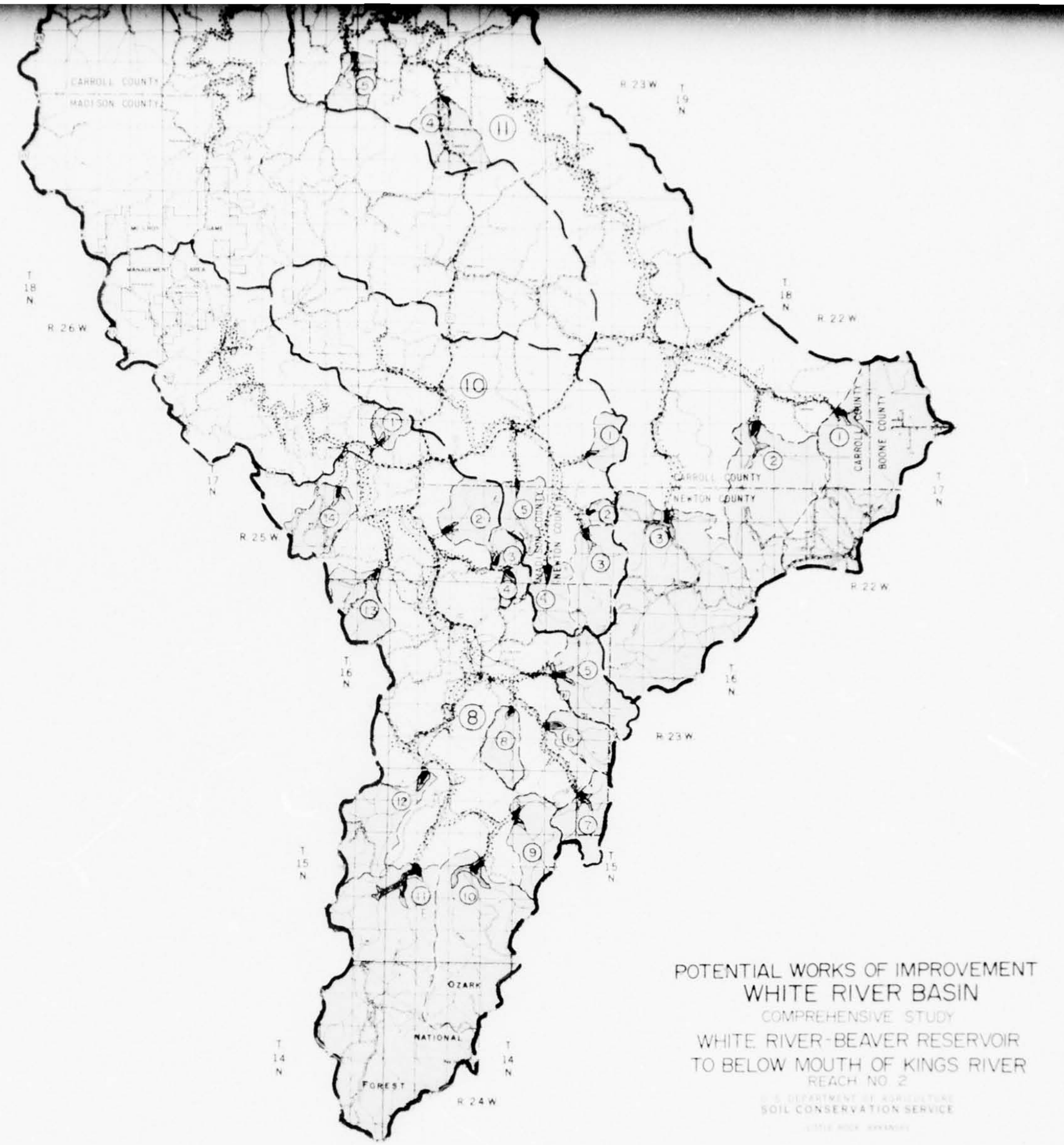


R 26 W
R 25 W
R 27 W
R 28 W
T 22 N
T 21 N
T 20 N
T 19 N
T 18 N
R 24 W
R 23 W
R 22 W
N A T I O N A L
F O R E S T
MISSOURI
ARKANSAS
BARRY COUNTY
CARROLL COUNTY
BENTON COUNTY
STONE COUNTY
MADISON COUNTY
LEGEND
Paved Road
Dirt Road
Pipeline
Railroad
Power Line
Drainage
Town or Community
County Line
Basin Boundary
Watershed Boundary
Single Purpose Structure
S-Municipal and Industrial
Floodwater Retarding Structure
Multiple Purpose Structure
S - Municipal and Industrial Storage
F - Fish and Wildlife Storage
Structure Site Number
Drainage Area Controlled by Structure
Benefited Area
Watershed Number

Railroad
Power Line
Drainage
Town or Community
County Line
Basin Boundary
Watershed Boundary
Single Purpose Structure
S-Municipal and Industrial
Floodwater Retarding Structure
Multiple Purpose Structure
S - Municipal and Industrial Storage
F - Fish and Wildlife Storage
Structure Site Number
Drainage Area Controlled by Structure
Benefited Area
Watershed Number

Map No.	Basin Division	*Drainage Area (Sq. Mi.)
7	*White River-Roaring River Reach	260
	Kings River	167
8	Upper Kings River	211
9	Lower Kings River	52
10	Dry Fork Kings River	52
11	Osage Creek	164

*Preliminary Data



POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
WHITE RIVER-BEAVER RESERVOIR
TO BELOW MOUTH OF KINGS RIVER
REACH NO. 2
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

4-R-22899

4-65 4-R-19959

PLATE No. P-22

(13)
UPPER JAMES RIVER WATERSHED
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	512	13	7796	25	8102
2	1083	14	1369	26	3470
3	819	15	392	27	408
4	826	16	966	28	1402
5	569	17	1811	29	1082
6	713	18	18082	30	576
7	1143	19	952	31	1773
8	563	20	1605	32	3947
9	2614	21	1709	33	1263
10	5149	22	1078	34	1715
11	1638	23	4717	35	9904
12	1788	24	1250	36	1198
				37	4415

(15)
LOWER JAMES RIVER WATERSHED
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	749	11	7712	21	1133
2	3610	12	2144	22	1202
3	4606	13	1075	23	454
4	1996	14	922	24	130
5	1984	15	966	25	205
6	2052	16	754	26	461
7	800	17	1052	27	83
8	1538	18	7123	28	90
9	1266	19	653	29	307
10	5958	20	1907	30	416
				31	506

(14)
FINLEY CREEK WATERSHED
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

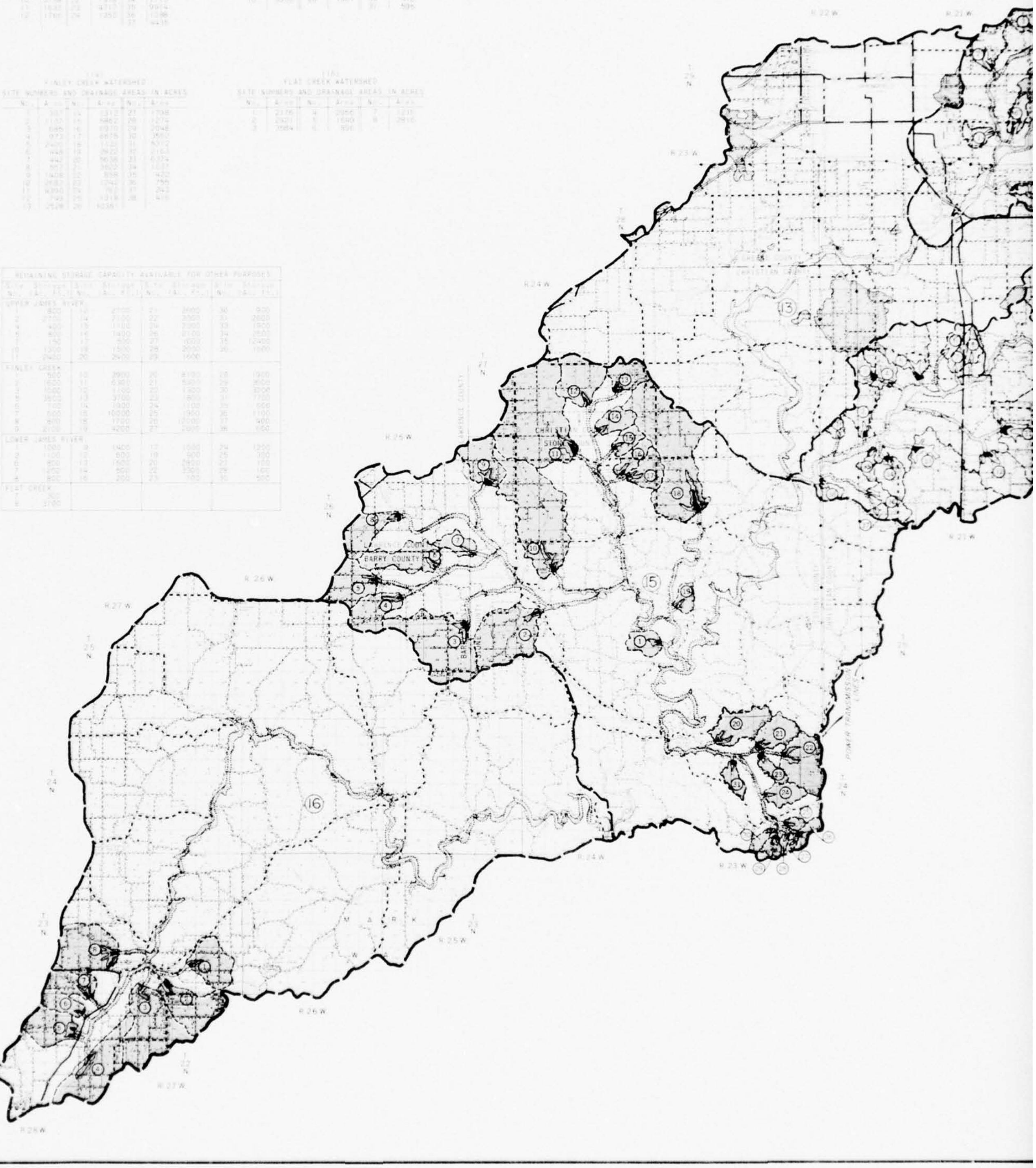
No.	Area	No.	Area	No.	Area
1	307	14	3312	27	1708
2	1127	15	6462	28	1276
3	885	16	5910	29	2048
4	973	17	6875	30	3862
5	2440	18	1120	31	5212
6	845	19	2920	32	2103
7	442	20	5638	33	6324
8	847	21	1602	34	1027
9	1408	22	898	35	422
10	2682	23	1042	36	755
11	4090	24	762	37	242
12	749	25	1318	38	416
13	2528	26	1036		

(16)
FLAT CREEK WATERSHED
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	2176	4	2056	7	1210
2	2601	5	1640	8	2916
3	3584	6	890		

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
UPPER JAMES RIVER							
1	800	13	2700	21	2600	30	900
3	2700	14	7100	22	2600	31	2600
4	400	15	1100	24	2200	33	1900
6	800	16	1400	26	2100	34	2500
7	150	17	500	27	1000	35	12400
10	1000	18	1500	28	2000	36	1600
11	2400	20	2400	29	1600		
FINLEY CREEK							
1	500	10	2900	20	8100	28	1900
2	1600	11	6300	21	5300	29	3600
3	1000	12	1100	22	1300	30	3200
4	3500	13	3700	23	1800	31	7700
5	700	14	1900	24	1100	35	800
7	600	15	10000	25	1900	36	1100
8	800	16	1700	26	12000	37	400
9	2100	19	4200	27	2800	38	100
LOWER JAMES RIVER							
1	1000	9	1400	17	1000	24	1200
2	1100	12	800	19	900	25	300
6	800	13	1600	20	2800	27	100
7	200	14	500	22	3300	28	100
8	800	16	200	23	700	30	500
FLAT CREEK							
7	300						
8	3700						



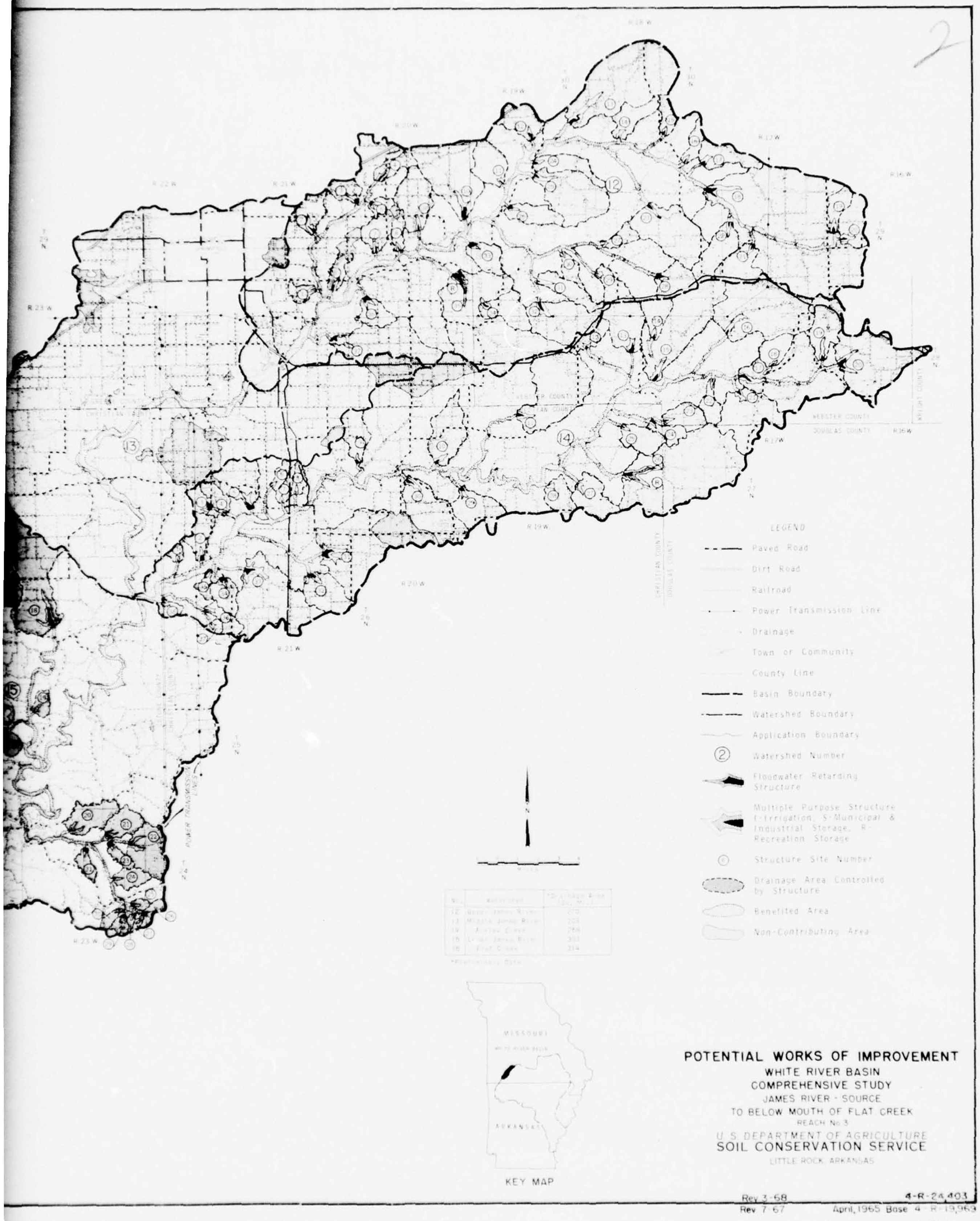
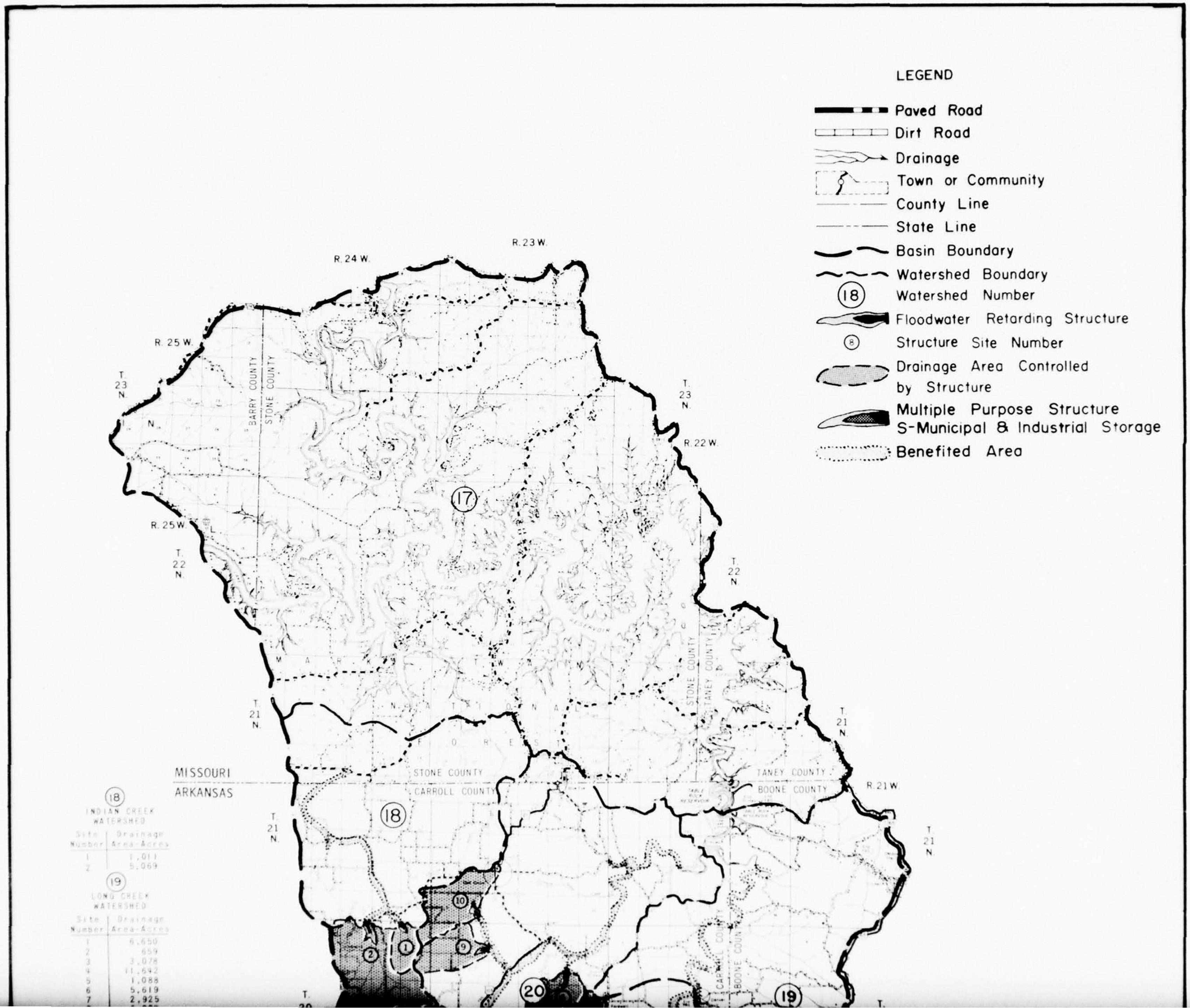

LEGEND
Paved Road
Dirt Road
Railroad
Power Transmission Line
Drainage
Town or Community
County Line
Basin Boundary
Watershed Boundary
Application Boundary
Watershed Number
Floodwater Retarding Structure
Multiple Purpose Structure I-Irrigation, S-Municipal & Industrial Storage, R-Recreation Storage
Structure Site Number
Drainage Area Controlled by Structure
Benefited Area
Non-Contributing Area
KEY MAP
MISSOURI
ARKANSAS
POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
JAMES RIVER - SOURCE
TO BELOW MOUTH OF FLAT CREEK
REACH No.3
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS
Rev 3-68
Rev 7-67
4-R-24,403
April, 1965 Base 4-R-19,969

PLATE No. P-23

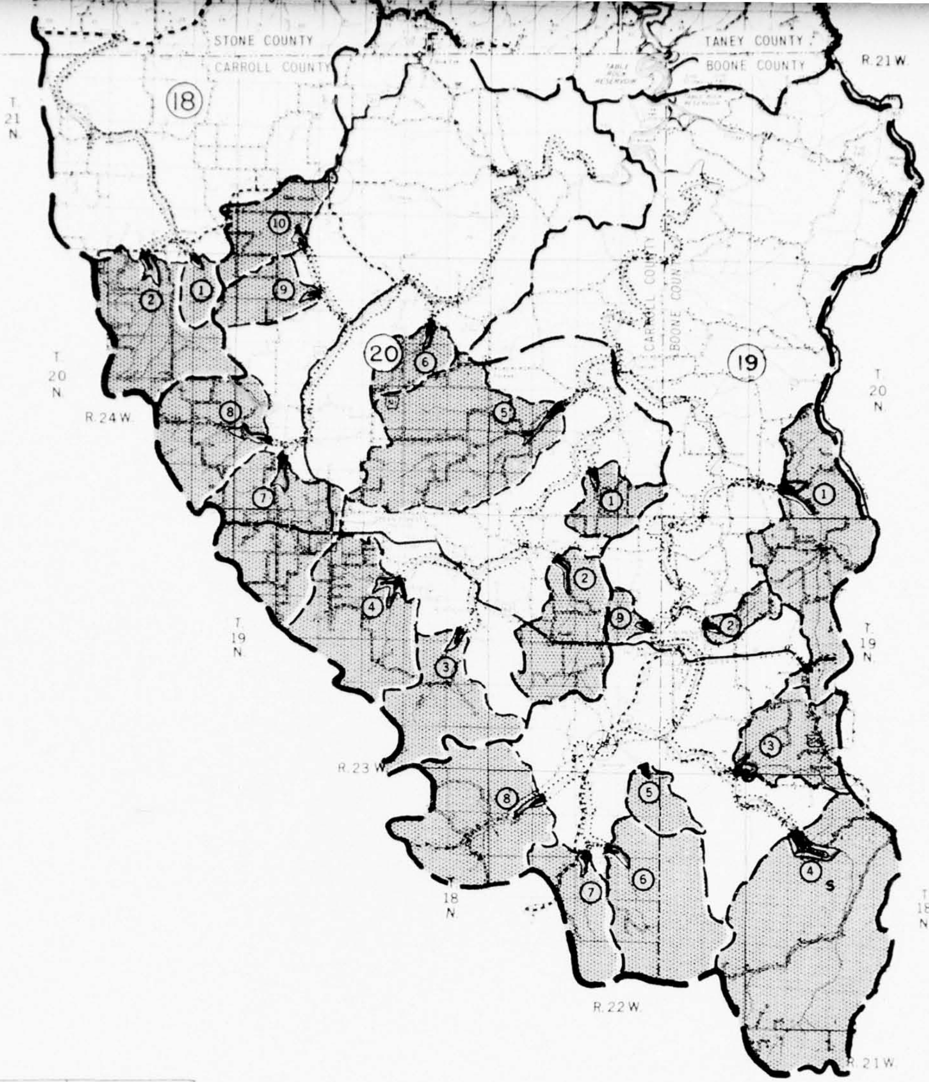


18 INDIAN CREEK WATERSHED

Site Number	Drainage Area-Acres
1	1,011
2	5,069

19 LONG CREEK WATERSHED

Site Number	Drainage Area-Acres
1	6,650
2	659
3	3,078
4	11,642
5	1,088
6	5,619
7	2,925



18 INDIAN CREEK WATERSHED

Site Number	Drainage Area-Acres
1	1,011
2	5,069

19 LONG CREEK WATERSHED

Site Number	Drainage Area-Acres
1	6,650
2	659
3	3,078
4	11,642
5	1,088
6	5,619
7	2,925
8	5,024
9	640

20 YOKUM-DRY CREEKS WATERSHED

Site Number	Drainage Area-Acres
1	1,498
2	3,430
3	3,302
4	5,395
5	6,317
6	1,280
7	4,813
8	3,290
9	1,568
10	1,850

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

INDIAN CREEK

Site Number	Storage (Ac. Ft.)
1	1,900
2	3,000

LONG CREEK

Site Number	Storage (Ac. Ft.)
2	1,300
3	4,500
4	16,300
5	900
6	5,000
7	2,500
8	1,000
9	1,200

YOKUM-DRY CREEKS

Site Number	Storage (Ac. Ft.)
3	3,000
5	4,000
7	22,300
8	10,000
9	2,700
10	3,400

No.	Watershed	*Drainage Area (Sq. Mi.)
17	Table Rock Laterals (excl. James R.)	276
18	Indian Creek	63
19	Long Creek	155
20	Yokum-Dry Creeks	138
	Total Reach	632

*Preliminary Data

N

0 1 2 3 4
MILES

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
WHITE RIVER-BELOW MOUTH OF KINGS RIVER TO TABLE ROCK DAM

REACH NO. 4

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Rev. 3-68 4-R-21809

Rev. 5-66 4-R-19966

PLATE No. P-24

munity

Boundary

dary

Number

Retarding Structure

ose Structure R-(Recreation)

rpose Structure R-(Recreation)

Site Number

rea Controlled by Structure

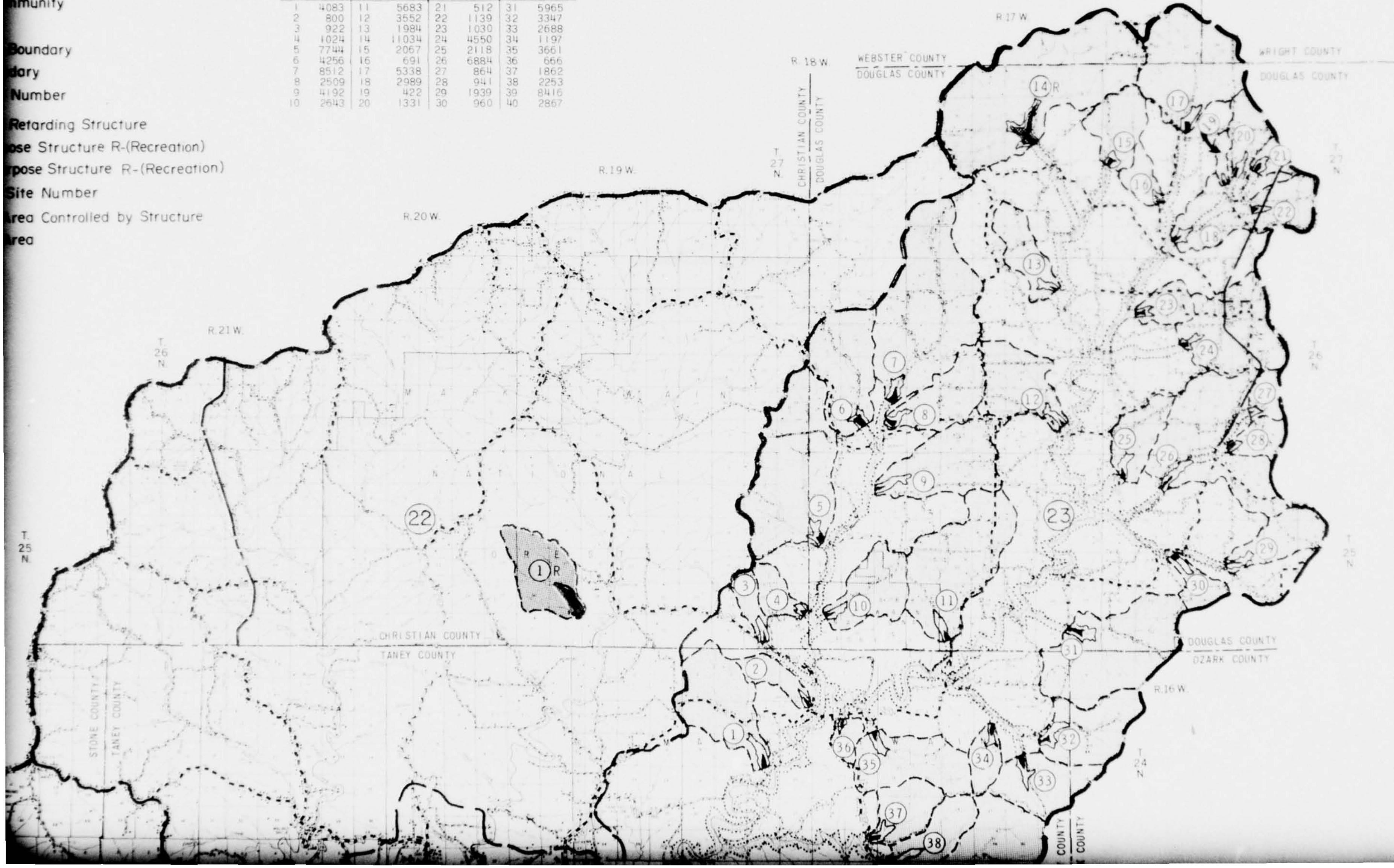
rea

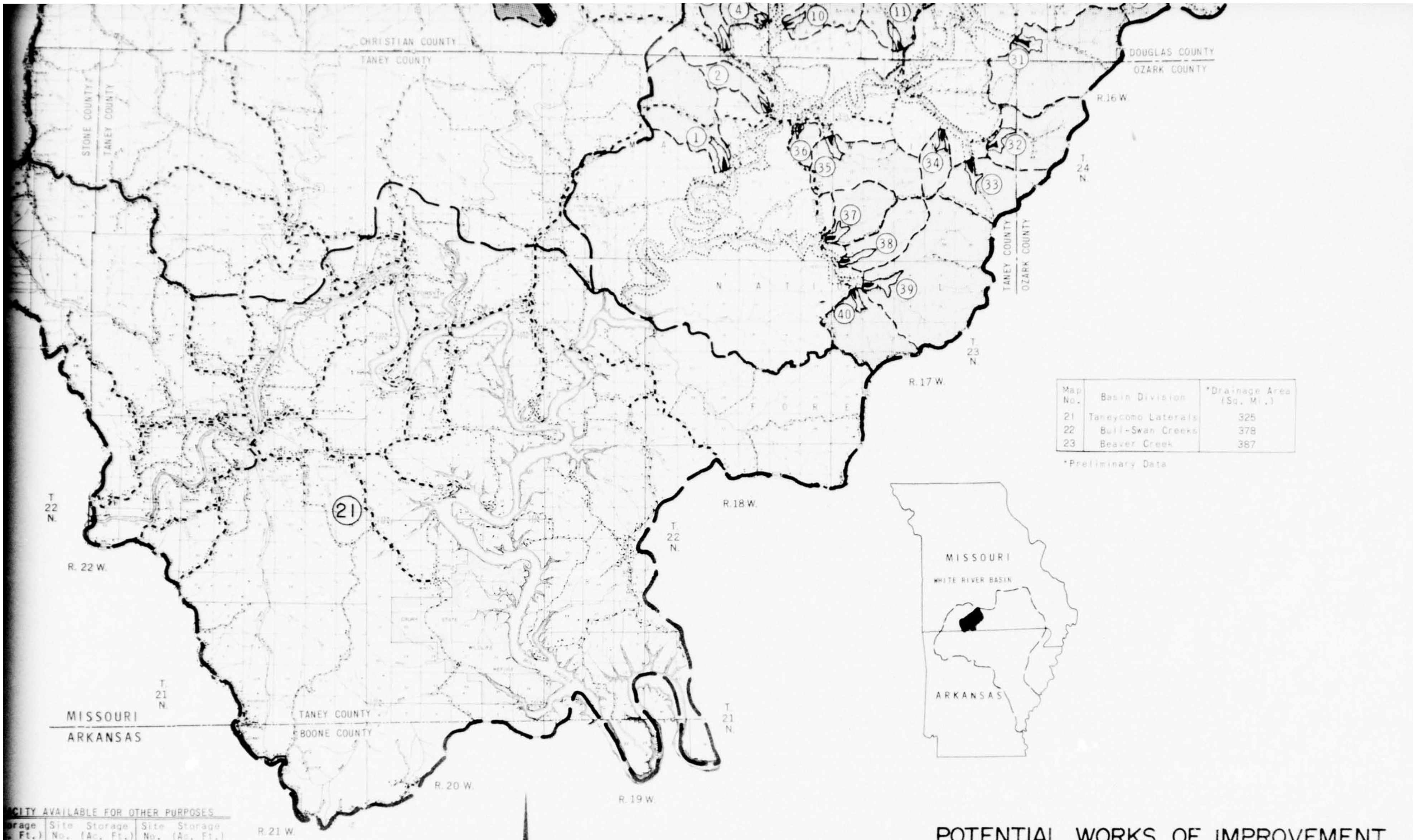
(22)
BULL-SWAN CREEKS WATERSHED

Site No.	Drainage Area (Acres)
1	2709

(23)
BEAVER CREEK WATERSHED
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area	No.	Area
1	4083	11	5683	21	512	31	5965
2	800	12	3552	22	1139	32	3347
3	922	13	1984	23	1030	33	2688
4	1024	14	11034	24	4550	34	1197
5	7744	15	2067	25	2118	35	3661
6	4256	16	691	26	6884	36	666
7	8512	17	5338	27	864	37	1862
8	2509	18	2989	28	941	38	2253
9	4192	19	422	29	1939	39	8416
10	2643	20	1331	30	960	40	2867





Map No.	Basin Division	*Drainage Area (Sq. Mi.)
21	Taneycomo Laterals	325
22	Bull-Swan Creeks	378
23	Beaver Creek	387

*Preliminary Data

...CITY AVAILABLE FOR OTHER PURPOSES

...rage (...Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
	22	1,700	32	5,400
300	23	1,600	33	4,400
3,200	24	4,500	34	1,900
5,500	25	3,400	35	5,900
1,200	27	1,300	36	1,000
4,100	28	1,500	37	3,000
400	29	3,000	38	3,100
2,100	30	1,500	39	13,300
800	31	9,500	40	1,300

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN COMPREHENSIVE STUDY
WHITE RIVER-TABLE ROCK DAM TO MISSOURI-ARKANSAS LINE

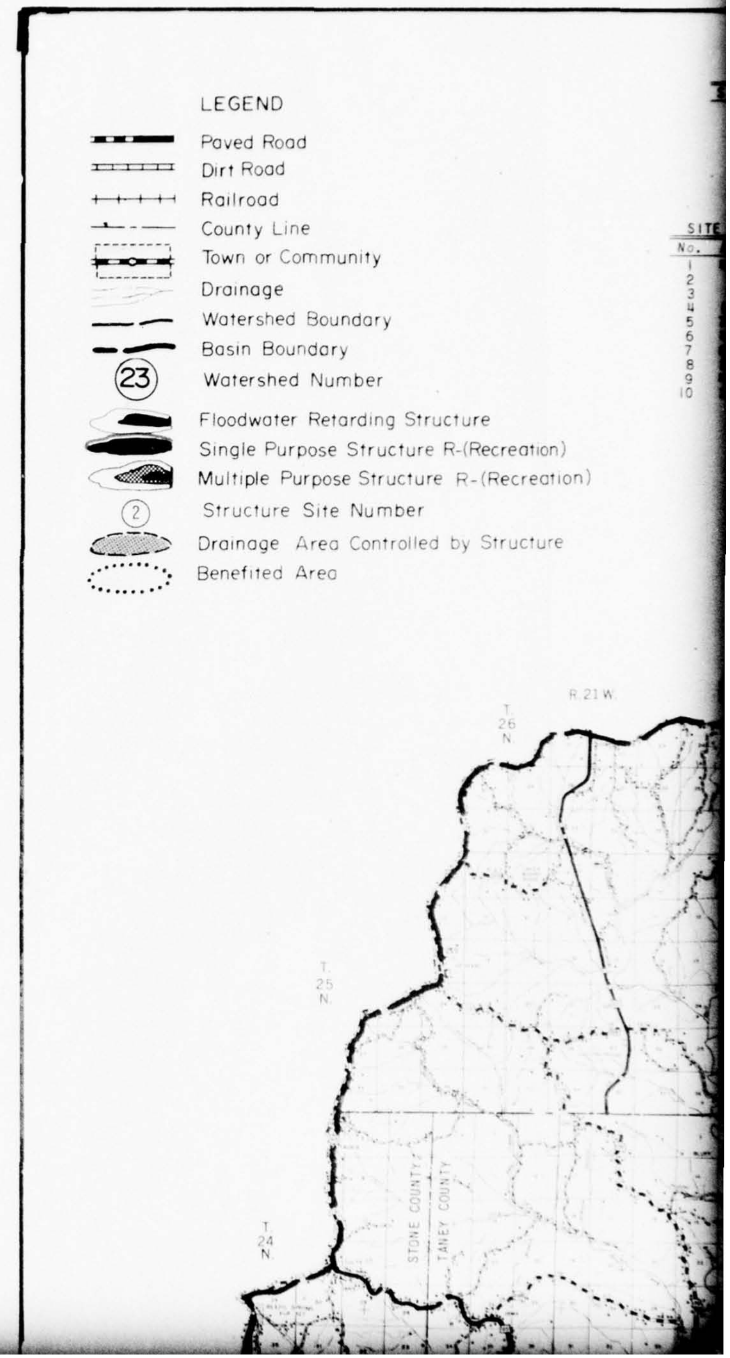
Reach No. 5

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

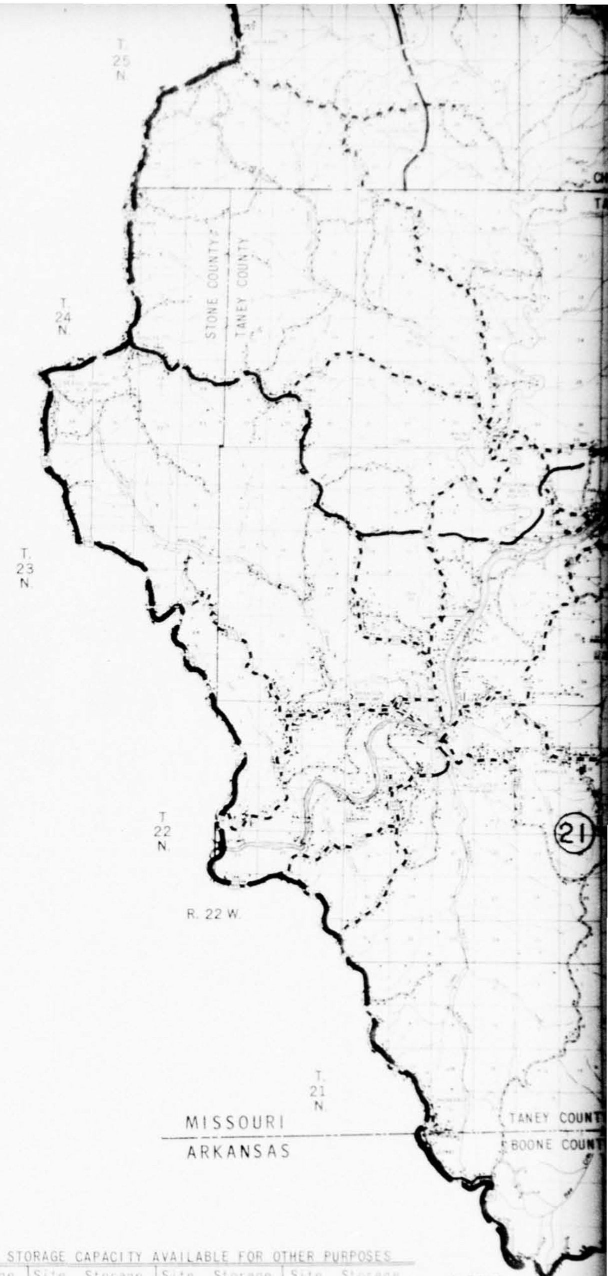
Rev. 3-68 4-R-24464
Rev. 7-67 4-R-20001

PLATE No. P-25

3



LEGEND
Paved Road
Dirt Road
Railroad
County Line
Town or Community
Drainage
Watershed Boundary
Basin Boundary
23 Watershed Number
Floodwater Retarding Structure
Single Purpose Structure R-(Recreation)
Multiple Purpose Structure R-(Recreation)
2 Structure Site Number
Drainage Area Controlled by Structure
Benefited Area
SITE
No.
1
2
3
4
5
6
7
8
9
10
R.21 W.
T. 26 N.
T. 25 N.
T. 24 N.
STONE COUNTY
TANEY COUNTY



REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
BULL-SWAN CREEKS:							
1	3,400						
BEAVER CREEK:				22	1,700	32	5,400
1	7,000	12	300	23	1,600	33	4,400
2	1,300	13	3,200	24	4,500	34	1,900
3	1,600	14	15,500	25	3,400	35	5,900
4	1,700	15	1,200	27	1,300	36	1,000
5	10,000	18	4,100	28	1,500	37	3,000
6	6,900	19	400	29	3,000	38	3,100
8	4,100	20	2,100	30	1,500	39	13,300
9	6,800	21	800	31	9,500	40	1,300

Base from General Highway Maps - 1961 through 1964 - Reproduction permission granted ... Department of Agriculture, Soil Cons
USDA SCS FORT WORTH, TEX. 1966

LEGEND

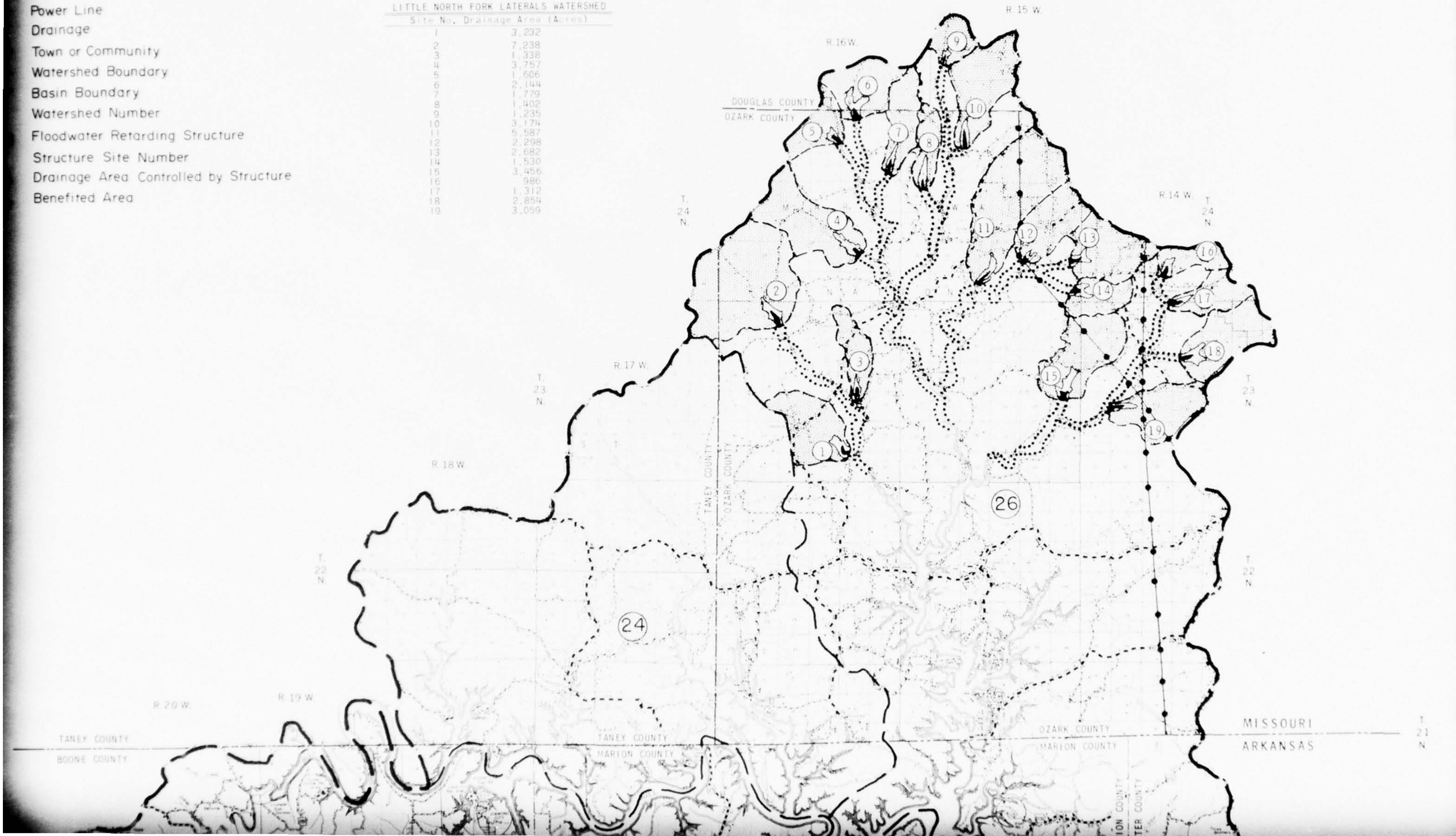
- Paved Road
- Dirt Road
- Railroad
- County Line
- Power Line
- Drainage
- Town or Community
- Watershed Boundary
- Basin Boundary
- Watershed Number
- Floodwater Retarding Structure
- Structure Site Number
- Drainage Area Controlled by Structure
- Benefited Area

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
LITTLE NORTH FORK LATERALS:					
1	5,700	8	2,000	14	2,500
2	12,200	9	2,100	15	4,100
3	2,300	10	5,400	16	1,200
4	6,400	11	9,400	17	2,200
5	2,700	12	3,900	18	3,400
7	3,000	13	4,500	19	5,100

(26)
LITTLE NORTH FORK LATERALS WATERSHED

Site No.	Drainage Area (Acres)
1	3,232
2	7,238
3	1,338
4	3,757
5	1,606
6	2,144
7	1,779
8	1,402
9	1,235
10	3,174
11	5,587
12	2,298
13	2,682
14	1,530
15	3,456
16	986
17	1,312
18	2,854
19	3,059



No.	Watershed	*Drainage Area (Sq. Mi.)
24	Upper Bull Shoals Laterals	186
25	Lower Bull Shoals Laterals	370
26	Little North Fork Lats.	370

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN COMPREHENSIVE STUDY

WHITE RIVER-MISSOURI, ARKANSAS LINE TO BULL SHOALS DAM

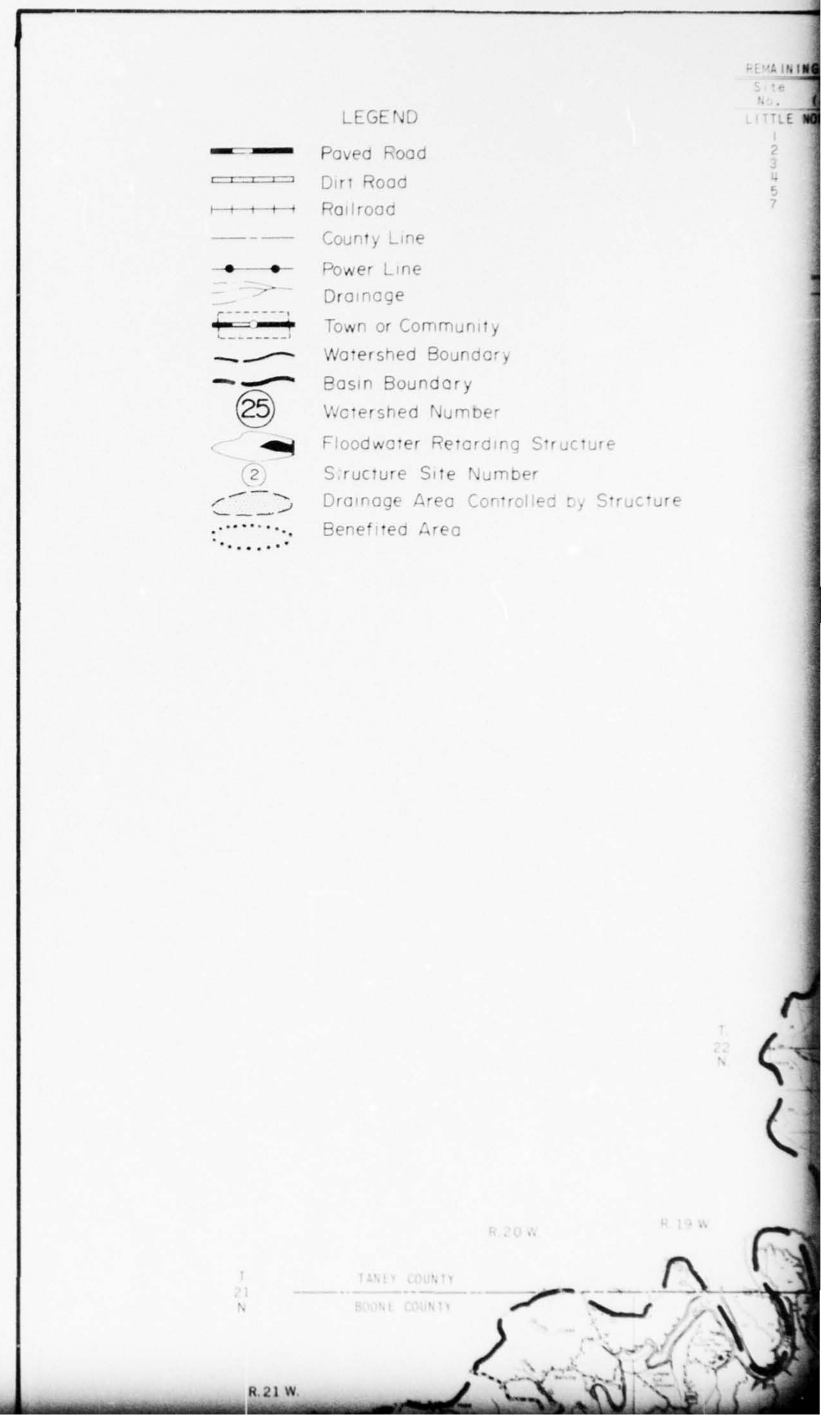
Reach No 6

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

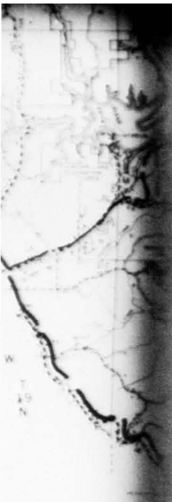
7-67 4-R-24522

Rev 7-67 4-R-20006

PLATE No. P-26



LEGEND
Paved Road
Dirt Road
Railroad
County Line
Power Line
Drainage
Town or Community
Watershed Boundary
Basin Boundary
25
Watershed Number
Floodwater Retarding Structure
2
Structure Site Number
Drainage Area Controlled by Structure
Benefited Area
REMAINING
Site No.
LITTLE NO
1
2
3
4
5
7
T. 22 N.
R. 20 W.
R. 19 W.
T. 21 N.
TANEY COUNTY
BOONE COUNTY
R. 21 W.



Map No.	Basin
35	Upper North
36	Lower North
37	Upper Norfork
	Bryant Cree
38	Upper Br
39	Lower B
40	Lower Norfo

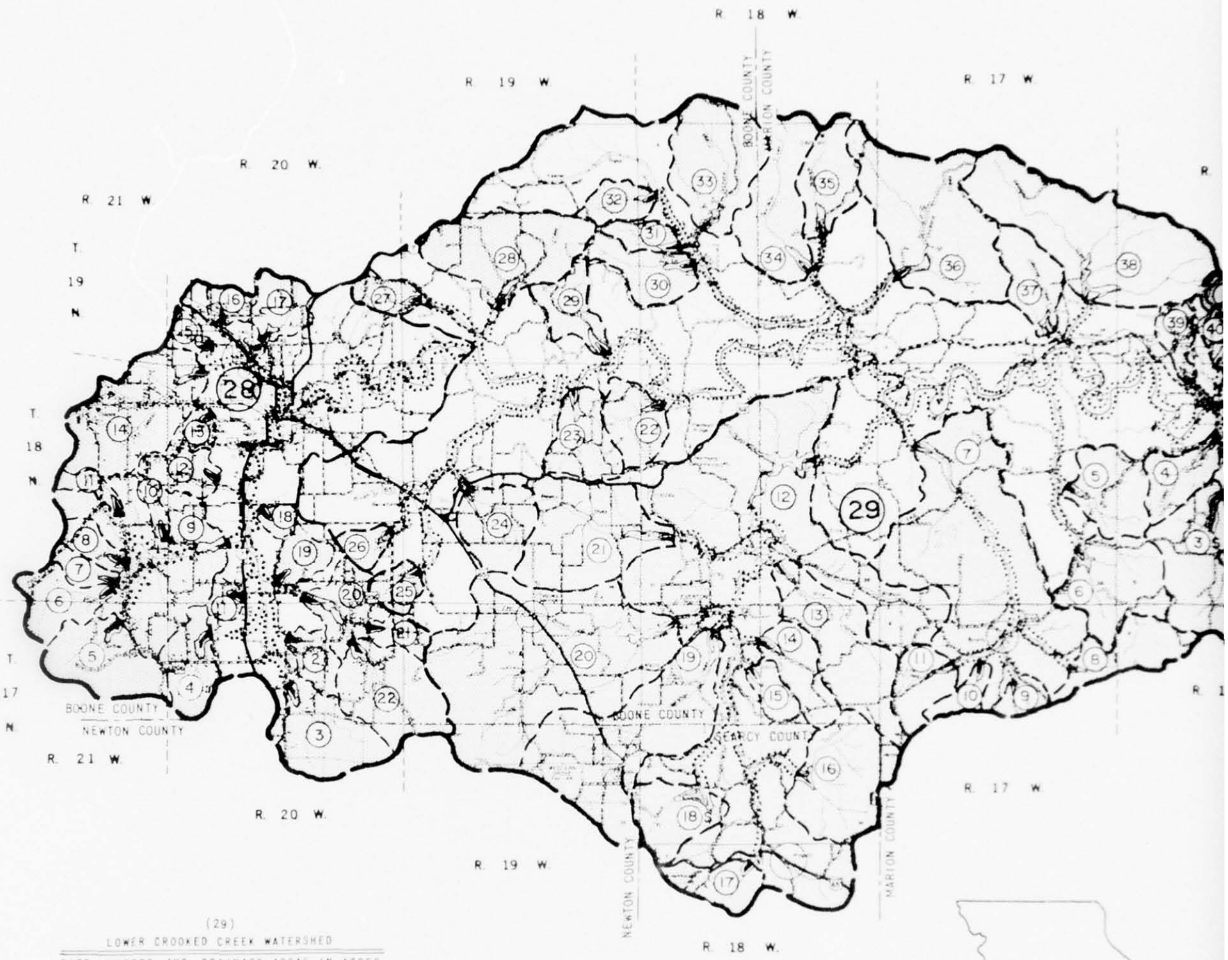
*Preliminary Data

No.	Watershed	*Drainage Area (Sq. Mi.)
24	Upper Bull Shoals Laterals	186
25	Lower Bull Shoals Laterals	370
26	Little North Fork Lats.	370

*Preliminary Data

USDA-SCS-FORT WORTH, TEX. 1969

4



(29)
LOWER CROOKED CREEK WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

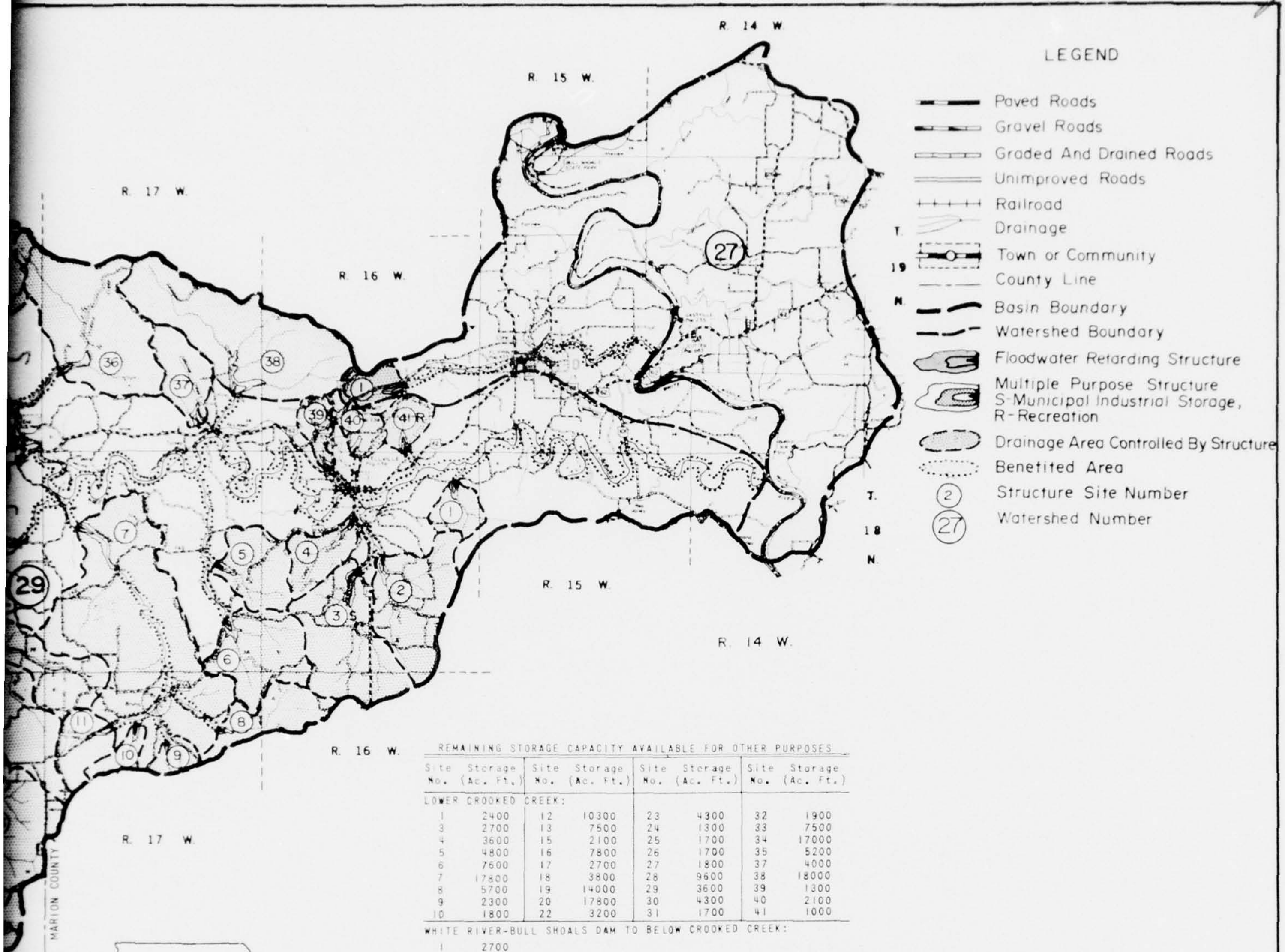
No.	Area	No.	Area	No.	Area
1	1107	15	1024	29	1696
2	3898	16	3738	30	1990
3	4218	17	1293	31	800
4	1728	18	2067	32	870
5	2240	19	6899	33	3488
6	3565	20	12454	34	7846
7	12378	21	5306	35	2438
8	2739	22	1498	36	7597
9	1120	23	1990	37	1869
10	870	24	1741	38	8346
11	1740	25	922	39	672
12	27200	26	774	40	1069
13	4486	27	845	41	1120
14	1843	28	4506		

(27)
WHITE RIVER - BULL SHOALS DAM TO BELOW CROOKED CREEK WATERSHED

Site No.	Drainage Area (Acres)
1	1248

No.	Watershed	Drainage Area (Sq.Mi.)
27	White River Bull Shoals to Below Mouth of Crooked Creek	111
28	Upper Crooked Creek (P.L. 566 Project)	88
29	Lower Crooked Creek	378

*Preliminary Data



REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
LOWER CROOKED CREEK:							
1	2400	12	10300	23	4300	32	1900
3	2700	13	7500	24	1300	33	7500
4	3600	15	2100	25	1700	34	17000
5	4800	16	7800	26	1700	35	5200
6	7600	17	2700	27	1800	37	4000
7	17800	18	3800	28	9600	38	18000
8	5700	19	14000	29	3600	39	1300
9	2300	20	17800	30	4300	40	2100
10	1800	22	3200	31	1700	41	1000
WHITE RIVER-BULL SHOALS DAM TO BELOW CROOKED CREEK:							
1	2700						

HOALS DAM
WATERSHED
ea (Acres)
48

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN

COMPREHENSIVE STUDY

WHITE RIVER - BULL SHOALS DAM
TO BELOW MOUTH OF CROOKED CREEK

REACH NO. 7

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Approximate Scale-Miles

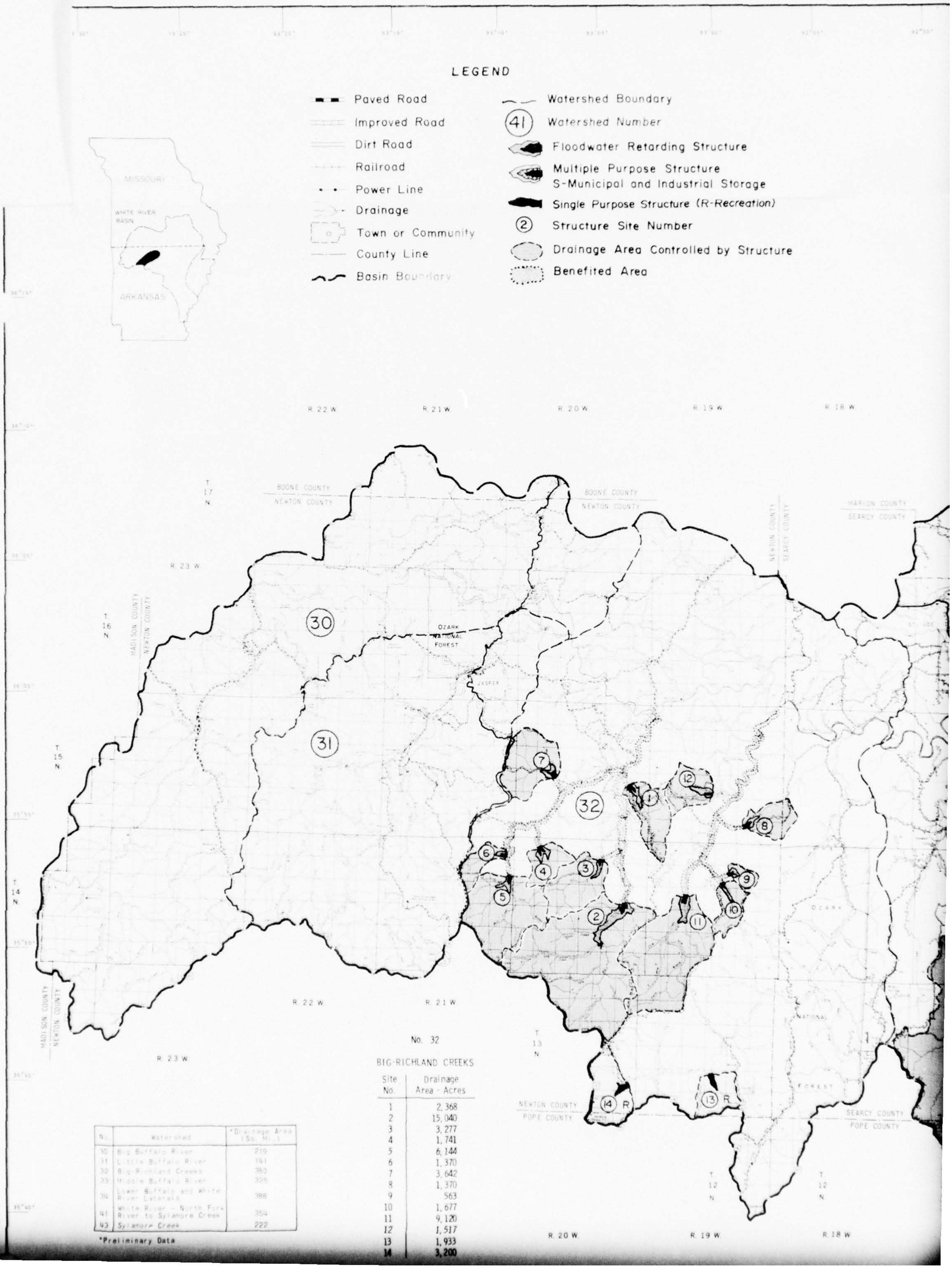
APPROXIMATE DRAINAGE AREA 577 SQUARE MILES

Rev 3-68 4-R-20703

Texas.

Rev. 10-65 4-R-19979

PLATE No. P-27



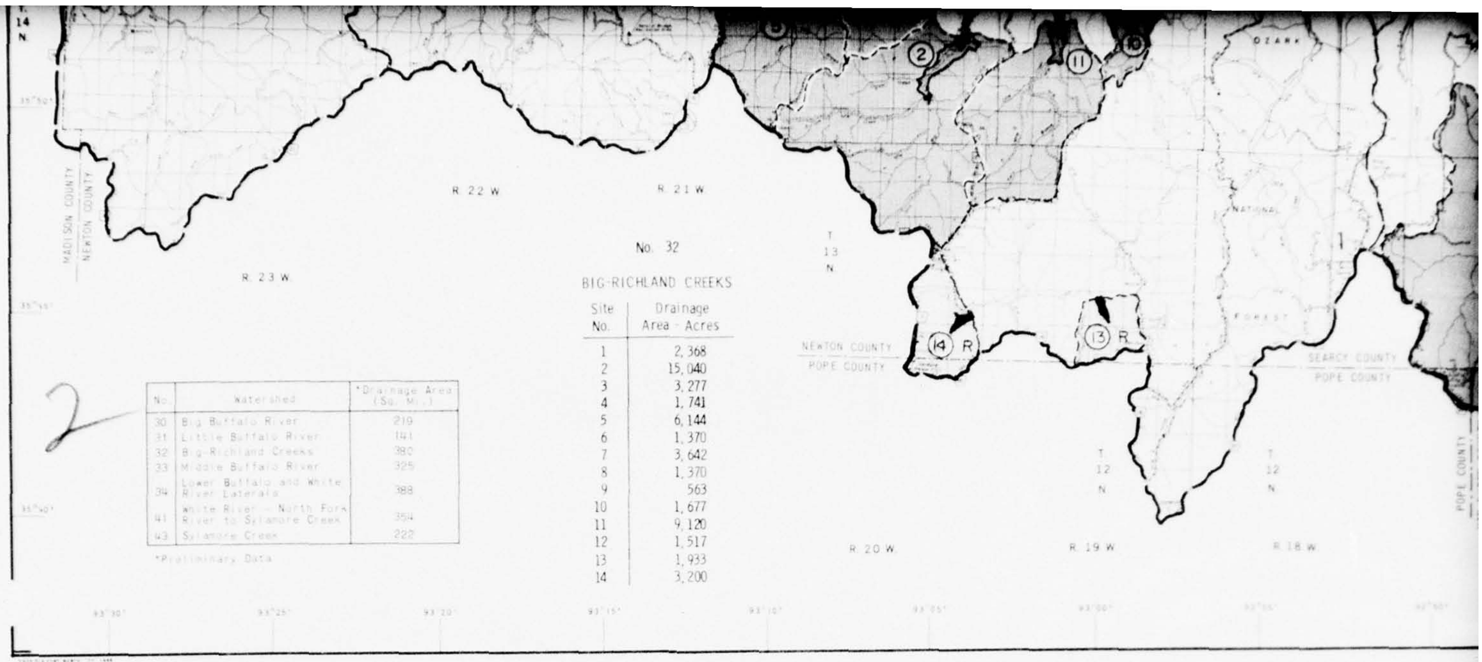
No. 32

BIG-RICHLAND CREEKS

Site No.	Drainage Area - Acres
1	2,368
2	15,040
3	3,277
4	1,741
5	6,144
6	1,370
7	3,642
8	1,370
9	563
10	1,677
11	9,120
12	1,517
13	1,933
14	3,200

No.	Watershed	*Drainage Area (Sq. Mi.)
30	Big Buffalo River	279
31	Little Buffalo River	141
32	Big-Richland Creeks	380
33	Middle Buffalo River	325
34	Lower Buffalo and White River Laterals	388
41	White River – North Fork River to Sylamore Creek	354
43	Sylamore Creek	222

*Preliminary Data



No. 32

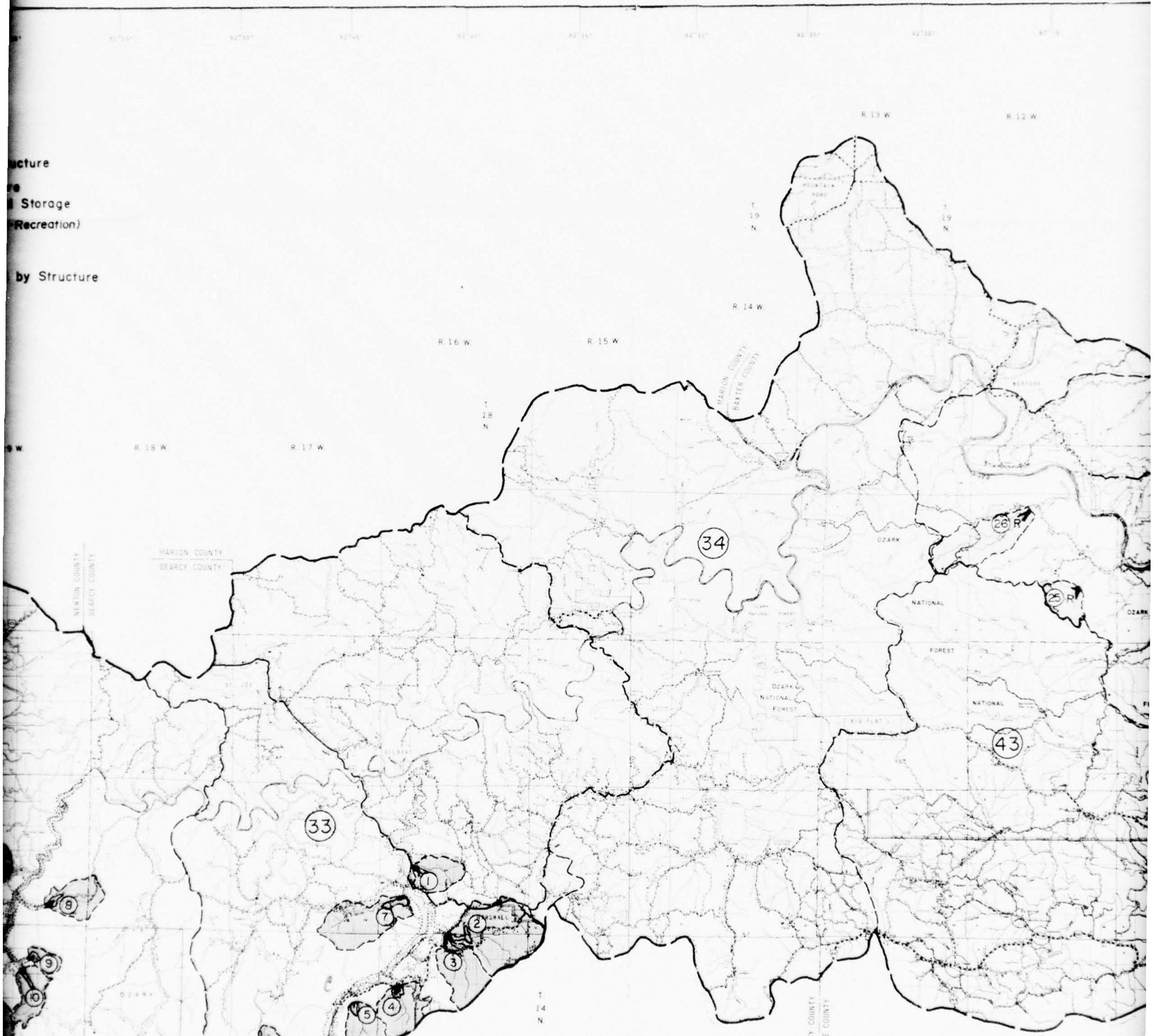
BIG-RICHLAND CREEKS

Site No.	Drainage Area - Acres
1	2,368
2	15,040
3	3,277
4	1,741
5	6,144
6	1,370
7	3,642
8	1,370
9	563
10	1,677
11	9,120
12	1,517
13	1,933
14	3,200

No.	Watershed	*Drainage Area (Sq. Mi.)
30	Big Buffalo River	219
31	Little Buffalo River	141
32	Big-Richland Creeks	380
33	Middle Buffalo River	325
34	Lower Buffalo and White River Laterals	388
41	White River - North Fork River to Sylamore Creek	354
43	Sylamore Creek	222

*Preliminary Data

3



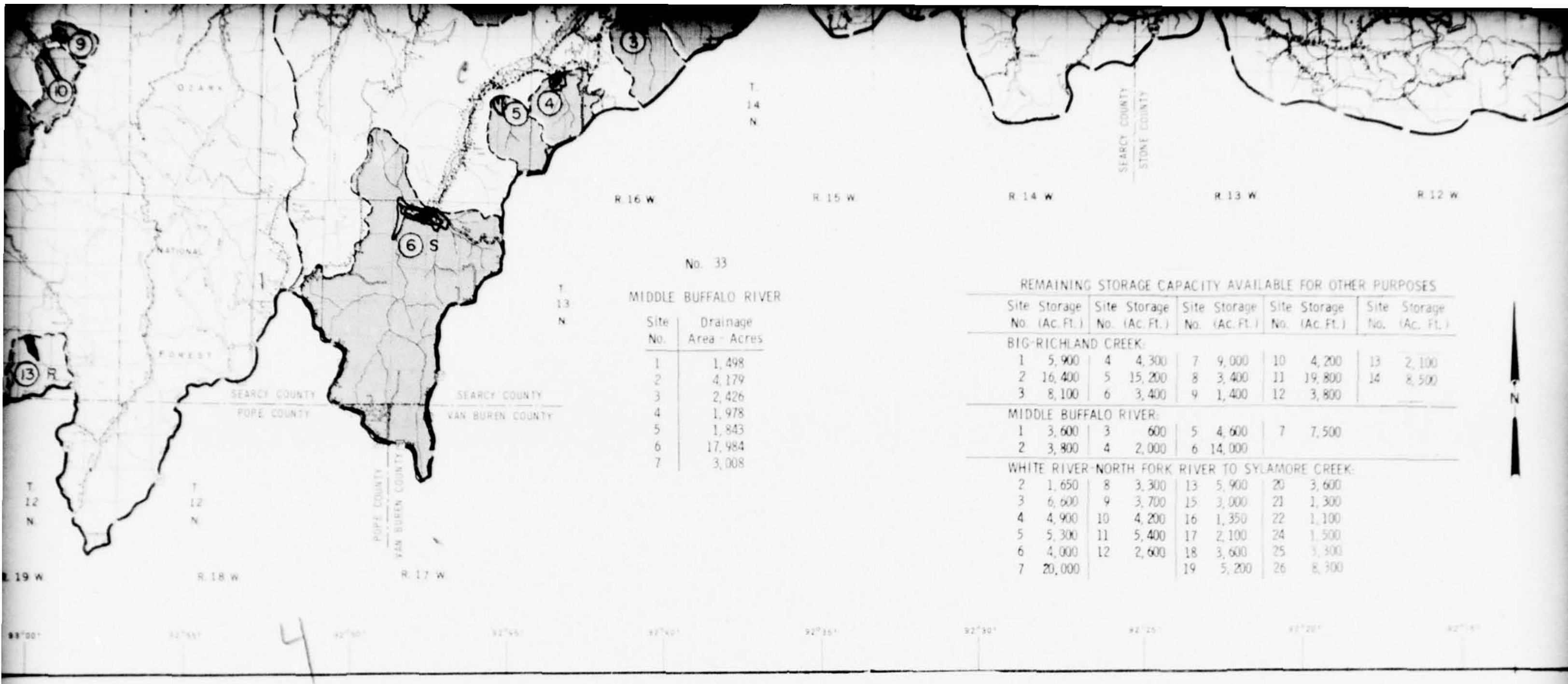
No. 33

MIDDLE BUFFALO RIVER

Site No.	Drainage Area - Acres
1	1,498
2	4,179
3	2,426
4	1,978
5	1,843
6	17,984

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
BIG-RICHLAND CREEK:									
1	5,900	4	4,300	7	9,000	10	4,200	13	2,100
2	16,400	5	15,200	8	3,400	11	19,800	14	8,500
3	8,100	6	3,400	9	1,400	12	3,800		
MIDDLE BUFFALO RIVER:									
1	3,600	3	600	5	4,600	7	7,500		
2	3,800	4	2,000	6	14,000				



No. 33

MIDDLE BUFFALO RIVER

Site No.	Drainage Area - Acres
1	1,498
2	4,179
3	2,426
4	1,978
5	1,843
6	17,984
7	3,008

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
BIG-RICHLAND CREEK:									
1	5,900	4	4,300	7	9,000	10	4,200	13	2,100
2	16,400	5	15,200	8	3,400	11	19,800	14	8,500
3	8,100	6	3,400	9	1,400	12	3,800		
MIDDLE BUFFALO RIVER:									
1	3,600	3	600	5	4,600	7	7,500		
2	3,800	4	2,000	6	14,000				
WHITE RIVER-NORTH FORK RIVER TO SYLAMORE CREEK:									
2	1,650	8	3,300	13	5,900	20	3,600		
3	6,600	9	3,700	15	3,000	21	1,300		
4	4,900	10	4,200	16	1,350	22	1,100		
5	5,300	11	5,400	17	2,100	24	1,500		
6	4,000	12	2,600	18	3,600	25	3,300		
7	20,000			19	5,200	26	8,300		

4

5

No. 41

WHITE RIVER-NORTH FORK RIVER TO SYLAMORE CREEK

Site No.	Drainage Area - Acres	Site No.	Drainage Area - Acres
1	3,206	13	2,381
2	2,195	14	3,411
3	2,669	15	1,190
4	1,971	16	1,824
5	2,131	17	2,106
6	1,600	18	1,446
7	8,512	19	2,099
8	4,173	20	2,304
9	1,510	21	506
10	1,715	22	454
11	2,176	23	1,338
12	1,075	24	1,178
		25	1,517
		26	3,827

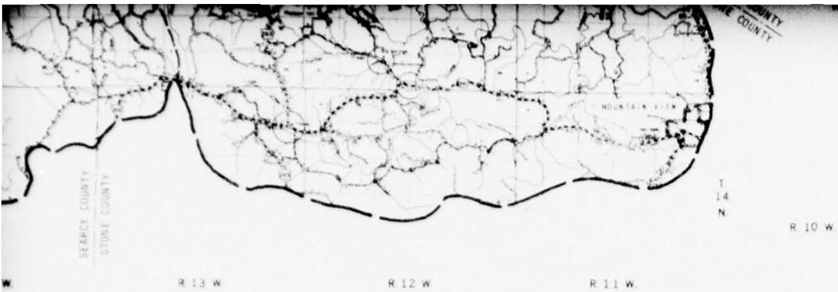
APACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
7	9,000	10	4,200	13	2,100
8	3,400	11	19,800	14	8,500
9	1,400	12	3,800		
5	4,600	7	7,500		
6	14,000				
RIVER TO SYLAMORE CREEK					
13	5,900	20	3,600		
15	3,000	21	1,300		
16	1,350	22	1,100		
17	2,100	24	1,500		
18	3,600	25	3,300		
19	5,200	26	8,300		

N

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
REACH NO. 8
WHITE RIVER - BELOW MOUTH OF CROOKED CREEK TO BELOW MOUTH OF SYLAMORE CREEK

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS



WHITE RIVER-NORTH FORK RIVER
TO SYLAMORE CREEK

Site No.	Drainage Area - Acres	Site No.	Drainage Area - Acres
1	3,206	13	2,381
2	2,195	14	3,411
3	2,669	15	1,190
4	1,971	16	1,824
5	2,131	17	2,106
6	1,600	18	1,446
7	8,512	19	2,099
8	4,173	20	2,304
9	1,510	21	506
10	1,715	22	454
11	2,176	23	1,338
12	1,075	24	1,178
		25	1,517
		26	3,827

AINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

torage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
ICHLAND CREEK:								
5,900	4	4,300	7	9,000	10	4,200	13	2,100
16,400	5	15,200	8	3,400	11	19,800	14	8,500
8,100	6	3,400	9	1,400	12	3,800		
E BUFFALO RIVER:								
3,600	3	600	5	4,600	7	7,500		
3,800	4	2,000	6	14,000				
RIVER-NORTH FORK RIVER TO SYLAMORE CREEK:								
1,650	8	3,300	13	5,900	20	3,600		
6,600	9	3,700	15	3,000	21	1,300		
4,900	10	4,200	16	1,350	22	1,100		
5,300	11	5,400	17	2,100	24	1,500		
4,000	12	2,600	18	3,600	25	3,300		
20,000			19	5,200	26	8,300		

N

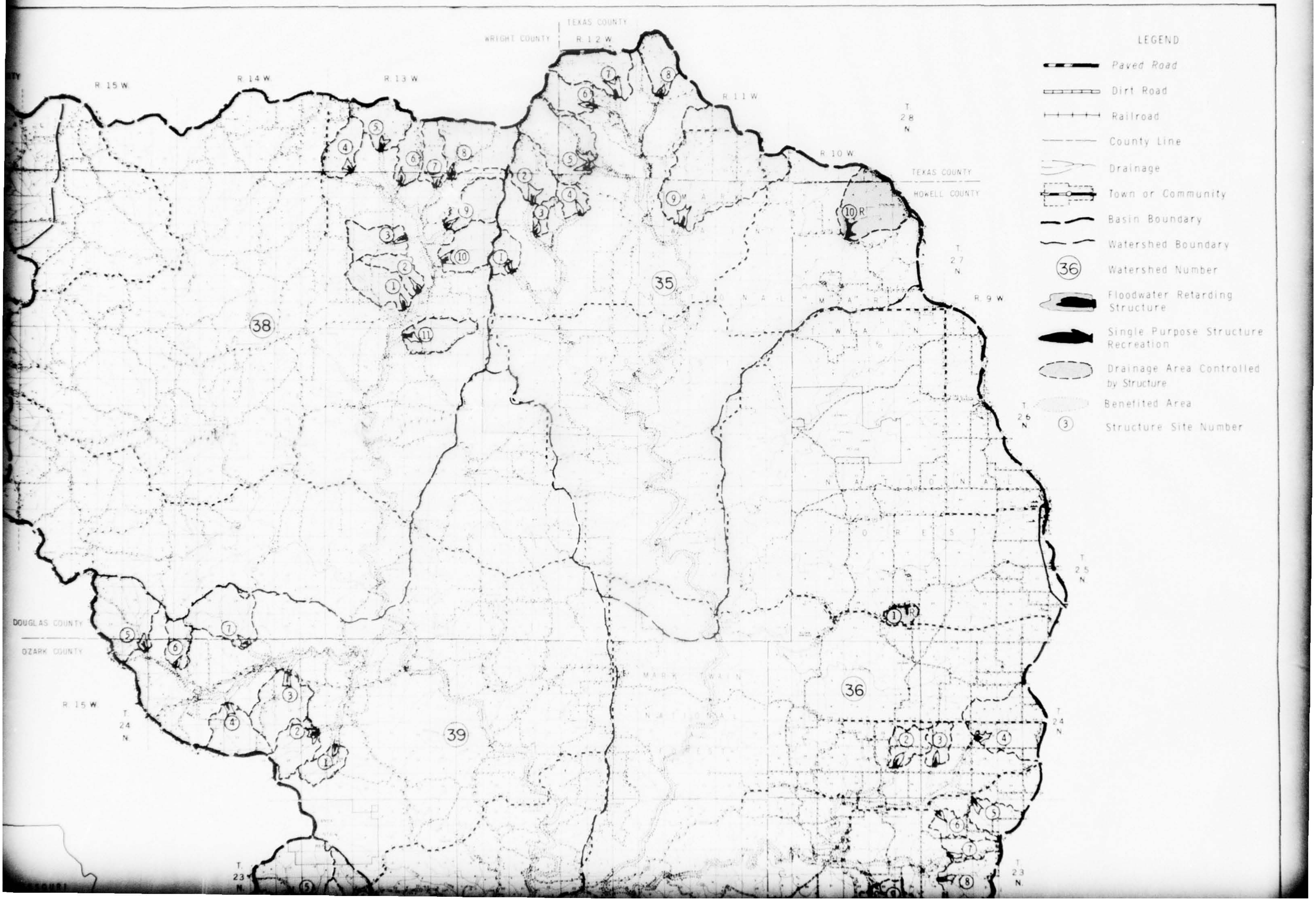
POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
REACH NO. 8
WHITE RIVER-BELOW MOUTH OF CROOKED CREEK
TO BELOW MOUTH OF SYLAMORE CREEK
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

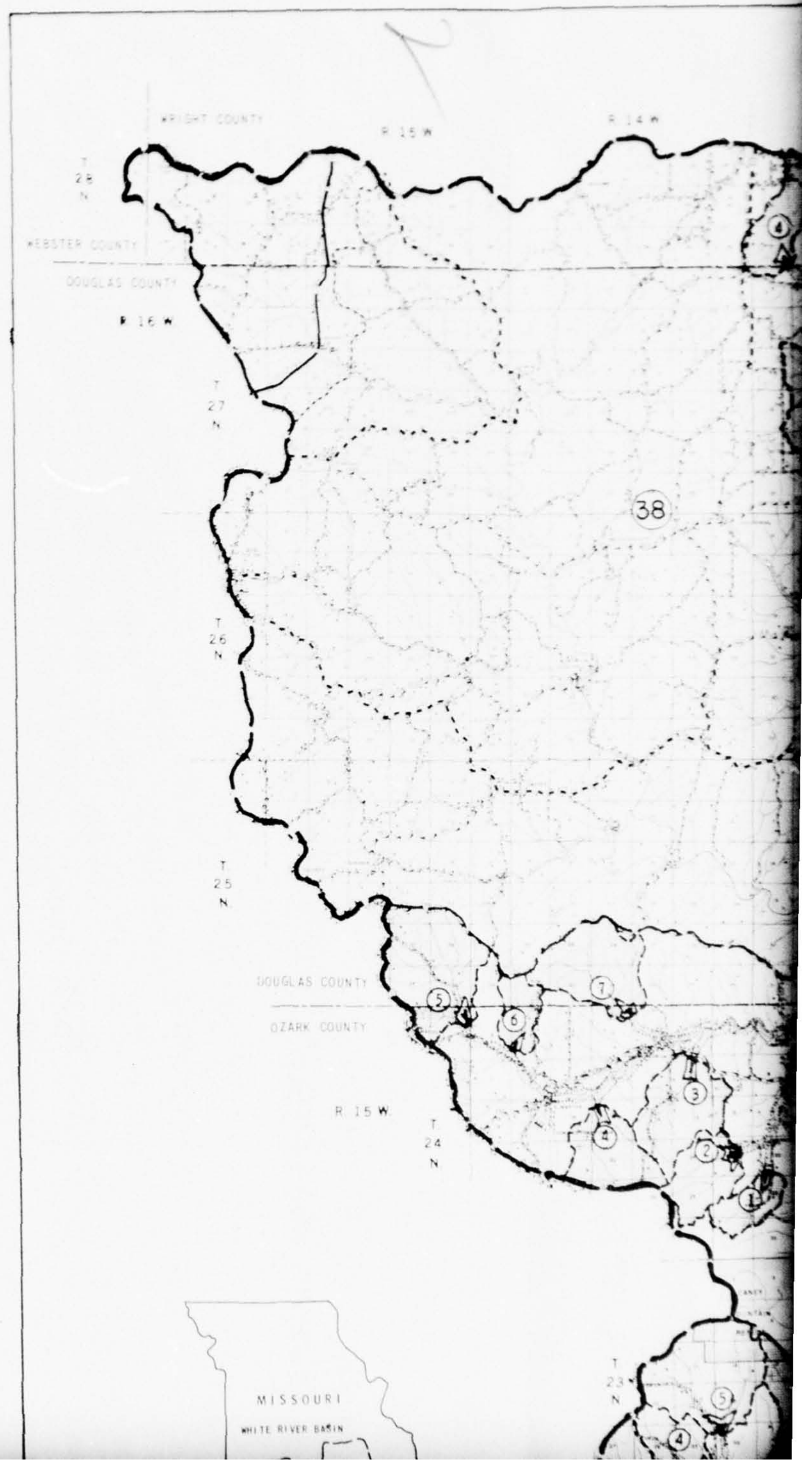
6

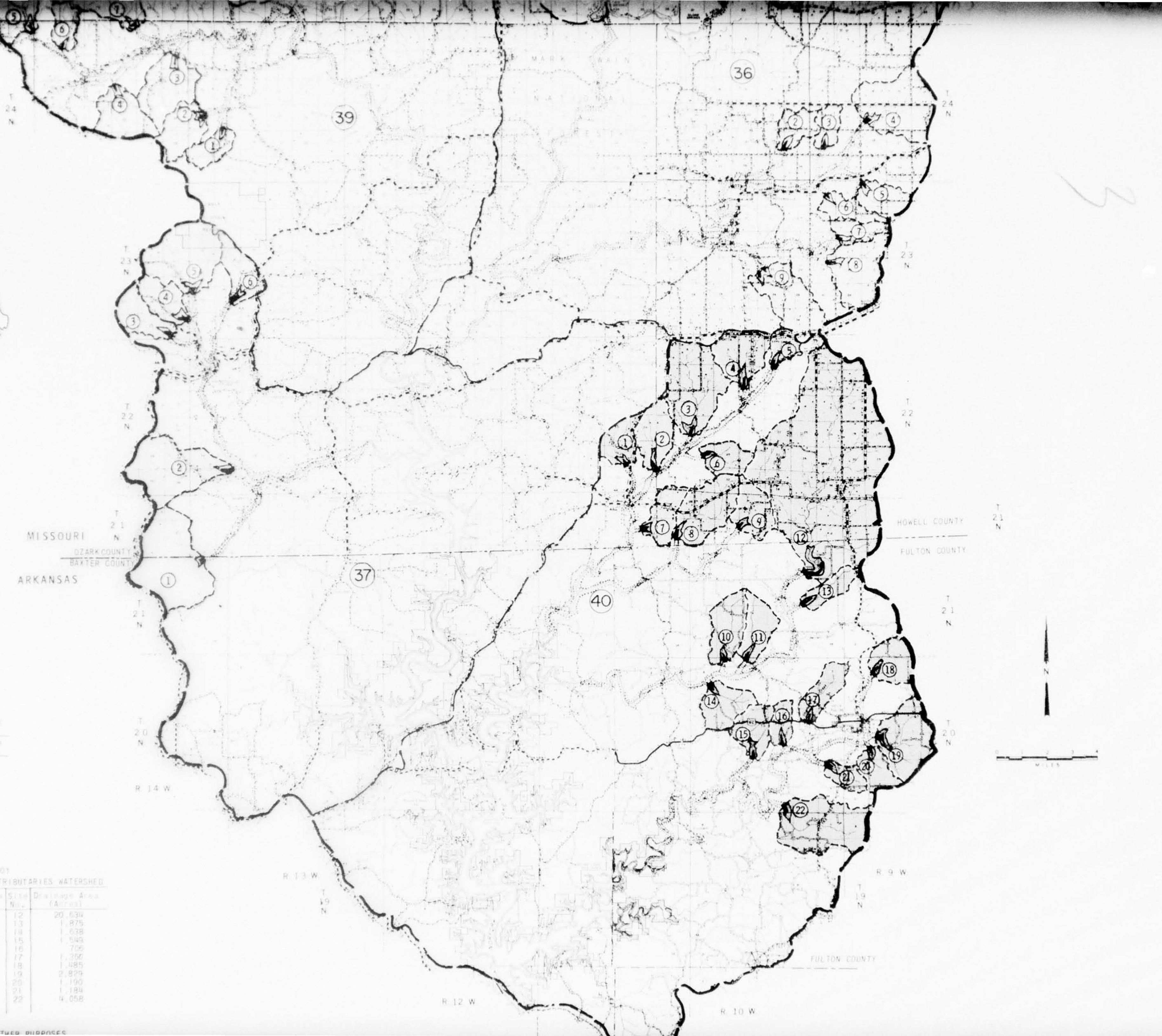
Rev. 6-68

4-R-20,928
Rev 3-68 4-R- 19926

PLATE No. P-28


LEGEND
Paved Road
Dirt Road
Railroad
County Line
Drainage
Town or Community
Basin Boundary
Watershed Boundary
Watershed Number
Floodwater Retarding Structure
Single Purpose Structure Recreation
Drainage Area Controlled by Structure
Benefited Area
Structure Site Number
WRIGHT COUNTY
TEXAS COUNTY
HOWELL COUNTY
DOUGLAS COUNTY
OZARK COUNTY
R 15 W
R 14 W
R 13 W
R 12 W
R 11 W
R 10 W
R 9 W
T 28 N
T 27 N
T 26 N
T 25 N
T 24 N
T 23 N
35
36
38
39
MARK TWAIN NATIONAL FOREST


WRIGHT COUNTY
R 15 W
R 14 W
T 28 N
WEBSTER COUNTY
DOUGLAS COUNTY
R 16 W
T 27 N
38
T 26 N
T 25 N
DOUGLAS COUNTY
OZARK COUNTY
R 15 W
T 24 N
T 23 N
MISSOURI
WHITE RIVER BASIN



ER WATERSHED

Drainage Area (Acres)
1,274
1,984
1,446
8,922
3,347

ER WATERSHED

Drainage Area (Acres)
1,318
1,101
3,014
3,565

(38)
UPPER BRYANT CREEK WATERSHED

Site No.	Drainage Area (Acres)
1	1,990
2	940
3	1,542
4	1,562
5	1,530
6	1,267
7	1,370
8	2,886
9	2,080
10	1,926
11	1,331

(40)
LOWER NORFORK DAM TRIBUTARIES WATERSHED

Site No.	Drainage Area (Acres)	Site No.	Drainage Area (Acres)
1	1,114	12	20,634
2	1,990	13	1,875
3	3,738	14	1,638
4	1,754	15	1,549
5	499	16	706
6	1,261	17	1,350
7	1,453	18	1,485
8	3,046	19	2,829
9	1,504	20	1,190
10	1,920	21	1,184
11	1,683	22	4,058

TY AVAILABLE FOR OTHER PURPOSES

(35)
UPPER NORTH FORK RIVER WATERSHED

Site No.	Drainage Area (Acres)	Site No.	Drainage Area (Acres)
1	934	6	1,274
2	1,862	7	1,984
3	550	8	1,446
4	774	9	8,922
5	4,218	10	3,347

(36)
LOWER NORTH FORK RIVER WATERSHED

Site No.	Drainage Area (Acres)	Site No.	Drainage Area (Acres)
1	819	6	1,318
2	1,133	7	1,101
3	883	8	3,014
4	4,058	9	3,565
5	1,459		

(37)
UPPER NORFORK DAM TRIBUTARIES WATERSHED

Site No.	Drainage Area (Acres)
1	5,811
2	4,269
3	1,453
4	1,542
5	4,480
6	1,574

(38)
UPPER BRYANT CREEK WATERSHED

Site No.	Drainage Area (Acres)
1	1,990
2	940
3	1,542
4	1,562
5	1,530
6	1,267
7	1,370
8	2,886
9	2,086
10	1,926
11	1,331

(39)
LOWER BRYANT CREEK WATERSHED

Site No.	Drainage Area (Acres)
1	1,229
2	1,926
3	2,630
4	2,720
5	3,910
6	1,088
7	2,893

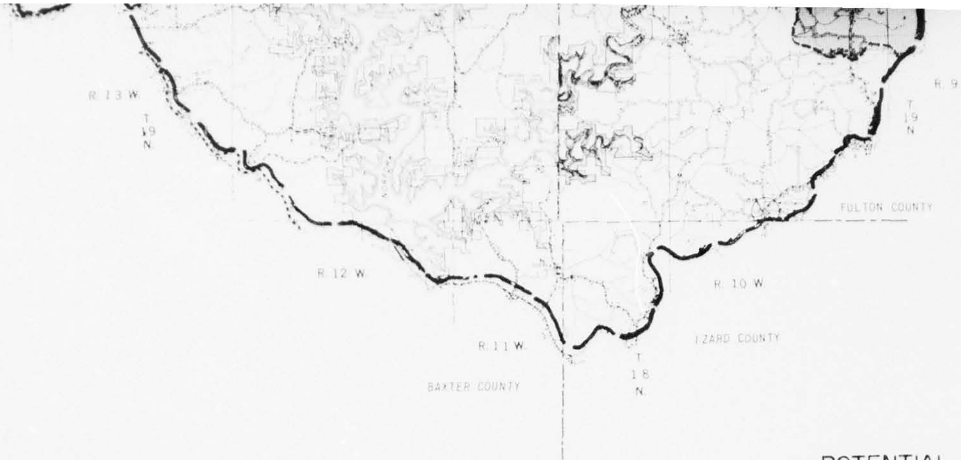
(40)
LOWER NORFORK DAM TRIBUTARIES WATERSHED

Site No.	Drainage Area (Acres)	Site No.	Drainage Area (Acres)
1	1,114	12	20,634
2	1,990	13	1,875
3	3,738	14	1,638
4	1,754	15	1,549
5	499	16	706
6	1,261	17	1,350
7	1,453	18	1,485
8	3,046	19	2,829
9	1,504	20	1,190
10	1,920	21	1,184
11	1,683	22	4,058

Site No.	Drainage Area (Acres)	Site No.	Drainage Area (Acres)
1	[illegible]	12	20,634
2	[illegible]	13	1,875
3	[illegible]	14	1,638
4	[illegible]	15	1,540
5	[illegible]	16	706
6	[illegible]	17	1,350
7	[illegible]	18	1,485
8	[illegible]	19	2,829
9	[illegible]	20	1,190
10	[illegible]	21	1,184
11	[illegible]	22	4,058

...TY AVAILABLE FOR OTHER PURPOSES

...age (...Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
...800	7	4,000	9	14,300
...200	8	3,000	10	4,600
...200	6	3,000	8	6,600
...300	7	2,600	9	7,900
...ARIES:				
...800	4	600	6	400
...900	9	2,400		
...900	10	3,700		
...600	11	800		
...000	5	1,500	7	5,500
...600	6	1,000		
...ARIES:				
...800	13	3,000	19	1,100
...800	14	3,700	20	700
...400	15	3,200	21	2,200
...300	16	800	22	2,300
...800	17	800		
...900	18	3,300		



Map No.	Basin Division	*Drainage Area (Sq. Mi.)
35	Upper North Fork River	213
36	Lower North Fork River	356
37	Upper Norfork Dam Tributaries	330
	Bryant Creek	
38	Upper Bryant Creek	341
39	Lower Bryant Creek	241
40	Lower Norfork Dam Tributaries	325

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY

NORTH FORK RIVER - SOURCE TO NORFORK DAM

REACH NO. 9

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

LITTLE ROCK, ARKANSAS

Rev. 10-67 4-R-24762

Revised 9-67 4-R-19983

PLATE No. P-29

Site No.	Drainage Area (Acres)	Site No.	Drainage Area (Acres)
2	1,133	7	1,101
3	883	8	3,014
4	4,058	9	3,565
5	1,459		

(37)
UPPER NORFORK DAM TRIBUTARIES WATERSHED

Site No.	Drainage Area (Acres)
1	5,811
2	4,269
3	1,453
4	1,542
5	4,480
6	1,574

(38)
UPPER BRYANT CREEK WATERSHED

Site No.	Drainage Area (Acres)
1	1,990
2	940
3	1,542
4	1,562
5	1,530
6	1,267
7	1,370
8	2,886
9	2,086
10	1,926
11	1,331

(39)
LOWER BRYANT CREEK WATERSHED

Site No.	Drainage Area (Acres)
1	1,229
2	1,926
3	2,630
4	2,720
5	3,910
6	1,088
7	2,893

(40)
LOWER NORFORK DAM TRIBUTARIES WATERSHED

Site No.	Drainage Area (Acres)	Site No.	Drainage Area (Acres)
1	1,114	12	20,634
2	1,990	13	1,875
3	3,738	14	1,638
4	1,754	15	1,549
5	499	16	706
6	1,261	17	1,350
7	1,453	18	1,485
8	3,046	19	2,829
9	1,504	20	1,190
10	1,920	21	1,184
11	1,683	22	4,058

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
UPPER NORTH FORK RIVER:							
2	2,900	4	1,600	7	4,000	9	14,300
3	1,100	6	1,200	8	3,000	10	4,600
LOWER NORTH FORK RIVER:							
1	1,300	4	9,200	6	3,000	8	6,600
2	2,500	5	3,300	7	2,500	9	7,900
3	2,000						
UPPER NORFORK DAM TRIBUTARIES:							
1	10,000	3	2,800	4	600	6	400
2	7,900						
UPPER BRYANT CREEK							
1	3,800	5	2,900	9	2,400		
2	1,800	6	1,900	10	3,700		
4	3,000	7	2,600	11	800		
LOWER BRYANT CREEK:							
1	2,400	3	2,000	5	1,500	7	5,500
2	3,700	4	1,600	6	1,000		
LOWER NORFORK DAM TRIBUTARIES:							
1	400	7	800	13	3,000	19	1,100
2	4,100	8	6,800	14	3,700	20	700
3	7,500	9	3,400	15	3,200	21	2,200
4	3,900	10	4,300	16	800	22	2,300
5	1,100	11	3,800	17	800		
6	2,800	12	14,900	18	3,300		

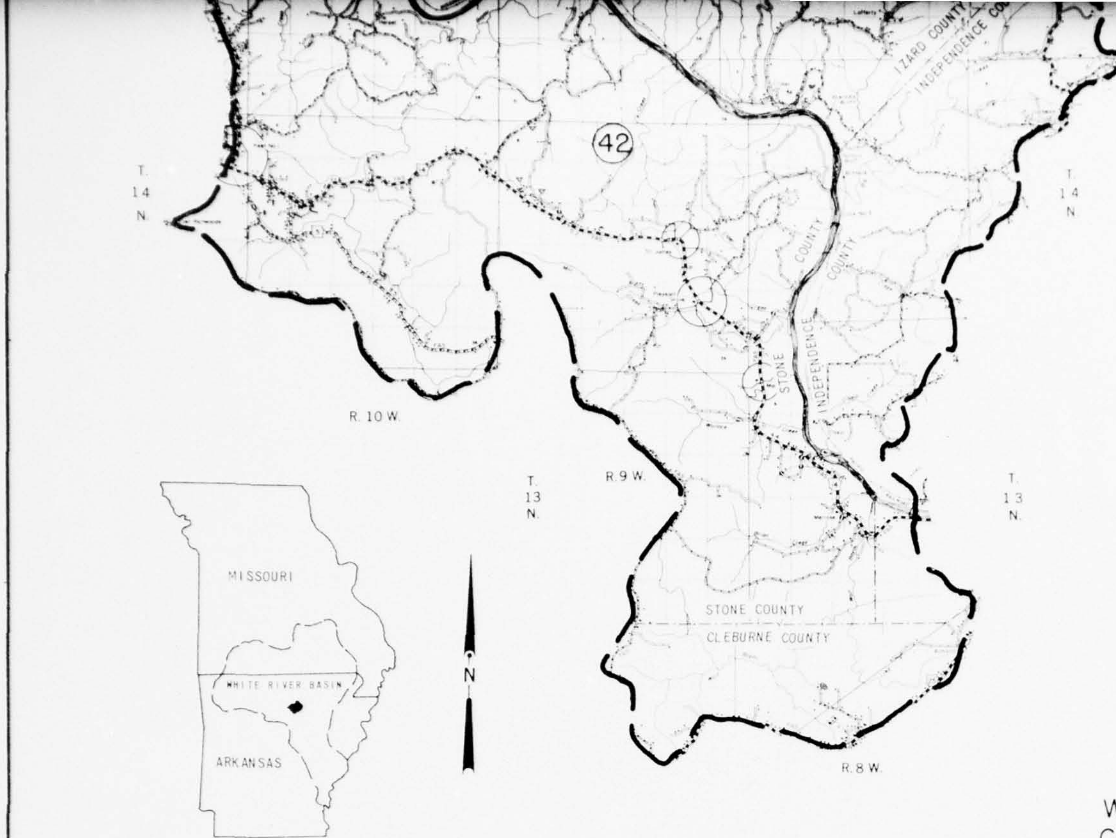
Map No.	Bas
35	Upper North
36	Lower North
37	Upper Norf
	Bryant C
38	Upper
39	Lower
40	Lower Norf

*Preliminary Da

USDA-SCS-FORT WORTH, TEX. 1968

6

LEGEND
Paved Road
Gravel Road
Gravel and Drained Road
Unimproved Road
Railroad
Drainage
Town or Community
County Line
Reach Boundary
Watershed Boundary
Watershed Number
R. 8 W.
R. 9 W.
R. 10 W.
T. 16 N.
T. 15 N.
T. 14 N.
T. 13 N.
IZARD COUNTY
INDEPENDENCE COUNTY
STONE COUNTY
CLEBURNE COUNTY
42
MISSOURI



No.	Watershed	*Drainage Area (Sq. Mi.)
42	White River-Sylamore Creek to Below Wolf Bayou	348

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
WHITE RIVER-BELOW MOUTH OF SYLAMORE CREEK TO BELOW MOUTH OF WOLF BAYOU
REACH NO. 10

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

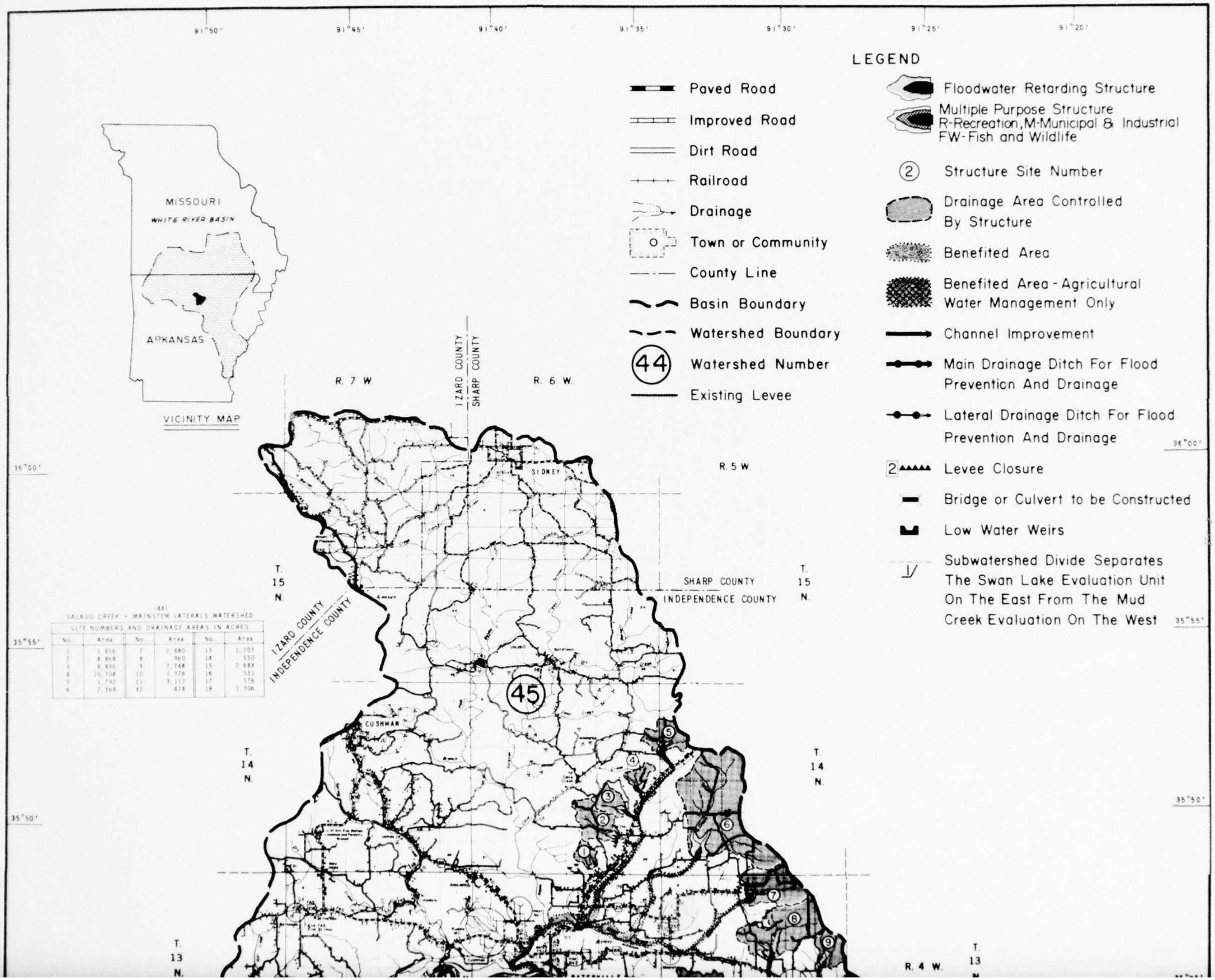
1 0 1 2 3 4
MILES

APPROXIMATE DRAINAGE AREA 348 SQUARE MILES

9-67 4-R-24831
Rev 9-67 4-R-20024

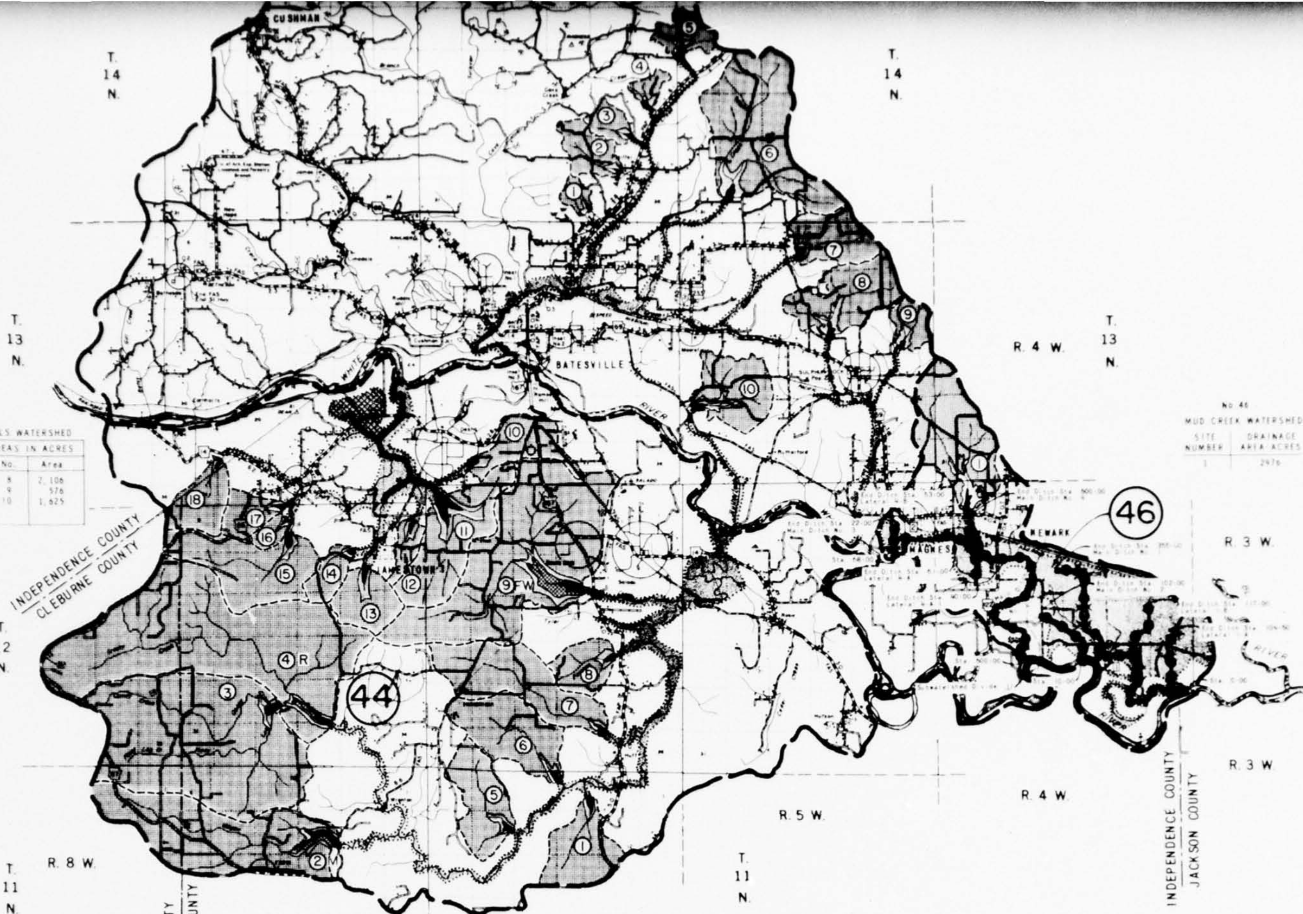
USDA-SCS-FORT WORTH, TEX. 1968

PLATE No. P-30



(44)
SALADO CREEK - MAINSTEM LATERALS WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	1,856	7	2,880	13	1,203
2	4,864	8	960	14	550
3	8,896	9	7,744	15	2,688
4	10,304	10	1,376	16	531
5	1,792	11	3,117	17	576
6	7,368	12	474	18	1,306



(45)
POLK BAYOU + MAINSTEM LATERALS WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	243	5	762	8	2,106
2	838	6	4,589	9	576
3	454	7	1,325	10	1,625
4	294				

No. 46
MUD CREEK WATERSHED (P. L. 566)

SITE NUMBER	DRAINAGE AREA ACRES
1	2976

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
SALADO CREEK + MAINSTEM LATERALS:					
1	2,800	7	6,800	13	1,900
2	3,900	8	2,300	14	400
3	20,200	9	17,000	15	5,700
4	6,500	10	3,400	16	1,200
5	2,100	11	7,700	17	1,400
6	2,100	12	1,200	18	3,200
POLK BAYOU + MAINSTEM LATERALS:					
1	600	5	1,000	8	1,500
2	700	6	3,000	9	1,400
3	750	7	1,600	10	2,000
4	750				

NO.	WATERSHED	*DRAINAGE AREA (Sq. Mi.)
44	Salado Creek + Mainsteam Laterals	184
45	Polk Bayou + Mainsteam Laterals	220
46	Mud Creek P. L. 566	29

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN COMPREHENSIVE STUDY

REACH NO. 11

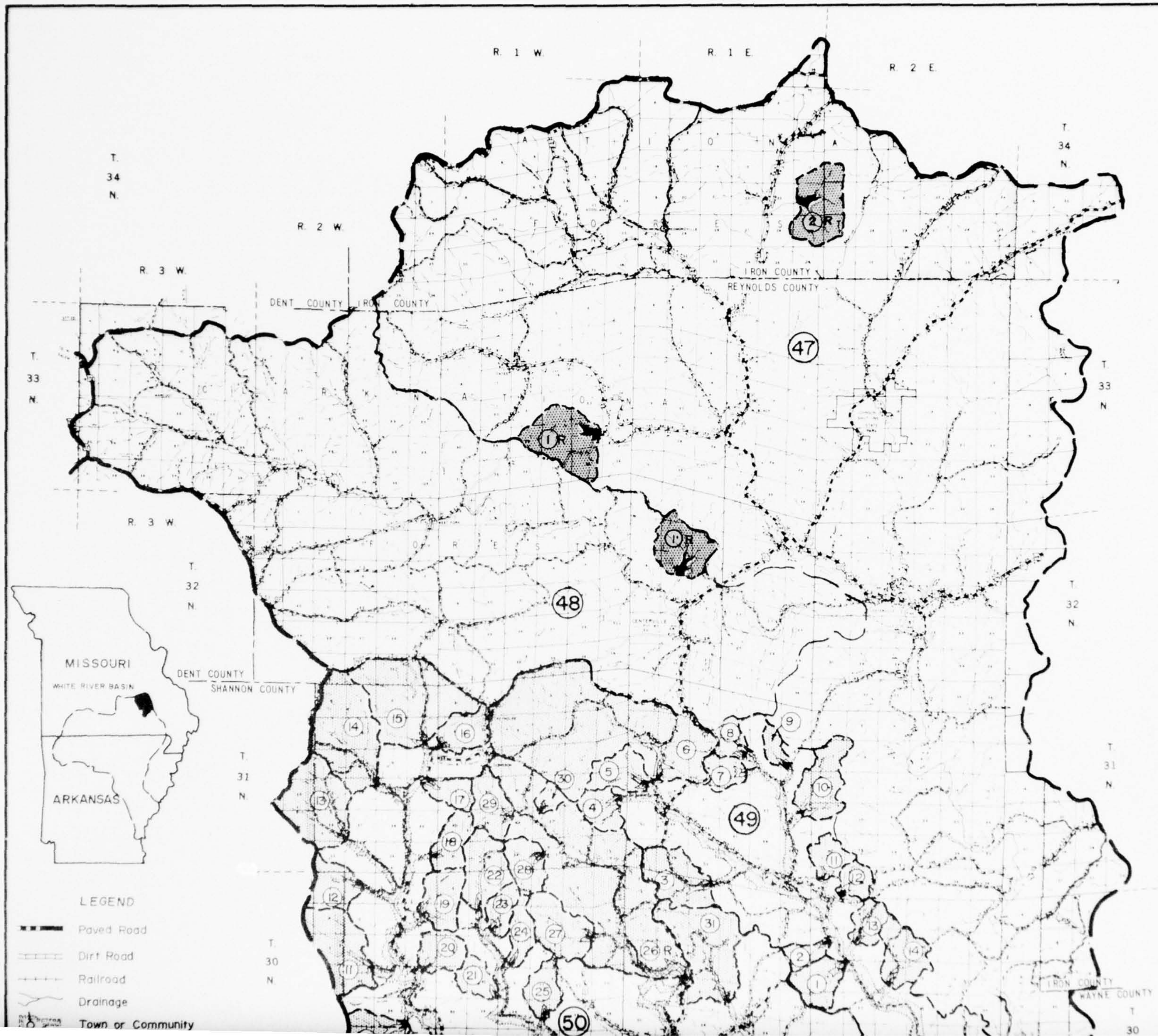
WHITE RIVER BELOW MOUTH OF WOLF BAYOU
TO ABOVE MOUTH OF BLACK RIVER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Approximate Drainage Area 433 Sq. Mi.

Rev. 3-68 4-R-20072
11-65 Base 4-R-19590

PLATE No. P-31


R. 1 W.
R. 1 E.
R. 2 E.
R. 2 W.
R. 3 W.
R. 3 W.
T. 34 N.
T. 34 N.
T. 33 N.
T. 33 N.
T. 32 N.
T. 32 N.
T. 31 N.
T. 31 N.
T. 30 N.
T. 30
DENT COUNTY
IRON COUNTY
IRON COUNTY
REYNOLDS COUNTY
DENT COUNTY
SHANNON COUNTY
IRON COUNTY
WAYNE COUNTY
47
48
49
50
MISSOURI
WHITE RIVER BASIN
ARKANSAS
LEGEND
Paved Road
Dirt Road
Railroad
Drainage
Town or Community

LEGEND

- Paved Road
- Dirt Road
- Railroad
- Drainage
- Town or Community
- County Line
- Basin Boundary
- Watershed Boundary
- (2) Watershed Number
- Floodwater Retarding Structure
- Multiple Purpose Structure (R-Recreation Storage)
- Single Purpose Structure Recreation
- (2) Structure Site Number
- Drainage Area Controlled by Structure
- Benefited Area

(47)
UPPER BLACK & CLEARWATER LATERALS WATERSHED

Site No.	Drainage Area-Acres	Site No.	Drainage Area-Acres
1	2637	2	2310

(48)
WEST FORK OF BLACK RIVER WATERSHED

Site No.	Drainage Area-Acres
1	1696

(49)
SINKING CREEK WATERSHED
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	1222	6	11802	11	858
2	563	7	730	12	621
3	1958	8	691	13	928
4	922	9	422	14	1139
5	1165	10	2118		

(50)
LOGAN CREEK WATERSHED
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	755	11	2554	21	755
2	320	12	1389	22	1869
3	1645	13	3411	23	1107
4	550	14	3974	24	870
5	1555	15	4269	25	1094
6	896	16	1312	26	11580
7	646	17	800	27	1952
8	1062	18	1043	28	1248
9	1446	19	1562	29	1395
10	1958	20	1069	30	403
				31	3744

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage Ac. Ft.	Site No.	Storage Ac. Ft.	Site No.	Storage Ac. Ft.	Site No.	Storage Ac. Ft.
UPPER BLACK & CLEARWATER LATERALS:							
1	5100	2	3600				
WEST FORK OF BLACK RIVER:							
1	2200						
SINKING CREEK:							
1	2800	6	7000	11	1900	14	2500
2	1300	7	1600	12	1400		
4	2100	9	900	13	2000		
LOGAN CREEK:							
1	1600	9	3100	17	1600	25	2400
2	700	10	4000	18	2100	27	4100
4	1200	11	5200	19	3200	28	2700
5	3500	12	1000	20	2200	29	3000
6	2000	13	6900	21	1500	30	900
7	1400	14	8000	23	2500		
8	2400	16	2700	24	1900		

No.	Watershed	*Drainage Area (Sq. Mi.)
47	Upper Black & Clearwater Laterals	390
48	West Fork of Black River	160
49	Sinking Creek	85
50	Logan Creek	263

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY

BLACK RIVER-SOURCE TO CLEARWATER DAM

REACH NO. 12

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Rev 9-1967 4-R-24327

REV. JUNE 1967 4-R-19971

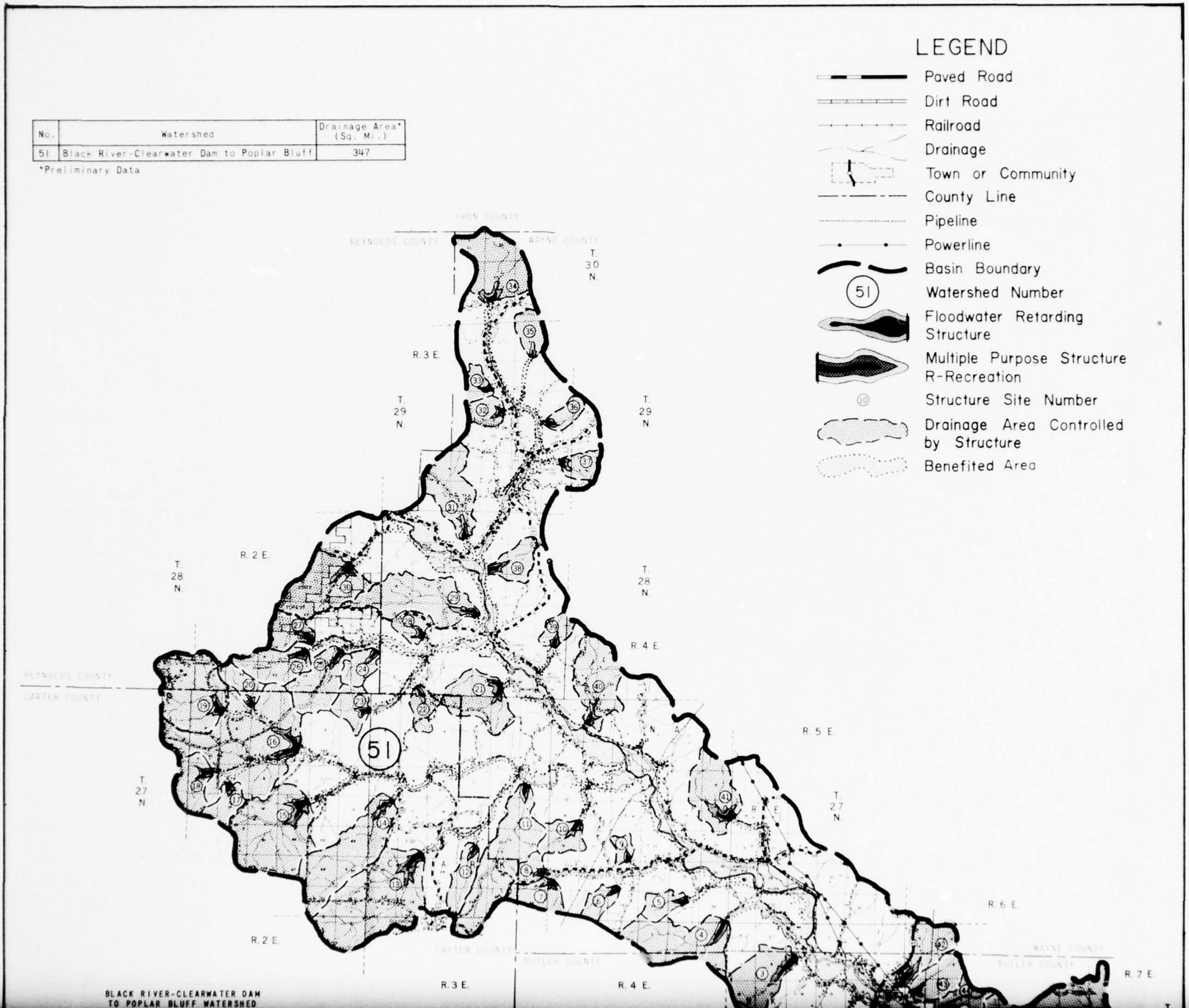
PLATE No. P-32

Base from General Highway Maps - 1960 through 1963 - Reproduction permission granted U. S. Department of Agriculture, Soil Conservation Service, Fort Worth, Texas.

USDA-SCS-FORT WORTH, TEX. 1968

No.	Watershed	Drainage Area* (Sq. Mi.)
51	Black River-Clearwater Dam to Poplar Bluff	347

*Preliminary Data



BLACK RIVER-CLEARWATER DAM TO POPLAR BLUFF WATERSHED

BLACK RIVER-CLEARWATER DAM
TO POPLAR BLUFF WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area	No.	Area
1	1,197	13	5,101	25	1,946	37	499
2	1,626	14	3,418	26	1,677	38	896
3	2,048	15	7,800	27	806	39	582
4	3,078	16	6,483	28	499	40	2,432
5	614	17	710	29	3,226	41	2,054
6	525	18	1,331	30	2,560	42	1,709
7	979	19	3,232	31	2,317	43	1,210
8	397	20	646	32	589	44	1,165
9	333	21	1,933	33	467	45	678
10	934	22	627	34	2,733	46	813
11	3,763	23	851	35	550	47	2,797
12	941	24	800	36	442	48	14,253

BLACK RIVER-CLEARWATER DAM TO POPLAR BLUFF
WATERSHED

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac.Ft.)	Site No.	Storage (Ac.Ft.)	Site No.	Storage (Ac.Ft.)
1	2,700	16	900	32	1,300
2	2,600	17	1,600	33	1,000
3	3,200	19	2,000	34	1,100
4	6,900	20	1,400	35	1,200
5	1,400	21	4,400	36	900
6	1,200	22	1,400	37	1,100
7	2,200	23	1,900	38	2,000
8	900	24	1,800	39	1,300
9	750	25	400	40	1,300
10	2,100	26	3,800	41	4,600
11	3,500	27	1,800	43	700
12	2,100	28	1,100	44	2,600
13	2,300	29	200	45	1,500
14	7,700	30	1,700	46	500

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN
COMPREHENSIVE STUDY

BLACK RIVER-CLEARWATER DAM TO POPLAR BLUFF

REACH NO. 13

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

1 0 1 2 3 4
MILES

APPROXIMATE DRAINAGE AREA 347 SQUARE MILES

Rev. 9-67 4-R-21557
Rev. 9-67 4-R-21556

Base from General Highway Map – 1962, 1963, 1964 – Reproduction permission granted U. S. Department of Agriculture, Soil Conservation Service, Fort Worth, Texas.
USDA-SCS-FORT WORTH, TEX. 1964

PLATE No. P-33

LEGEND

- Paved Road
- Dirt Road
- Pipeline
- Railroad
- Power Line
- Drainage
- Town or Community
- County Line
- Basin Boundary
- Watershed Boundary
- (53) Watershed Number
- Floodwater Retarding Structure
- Multiple Purpose Structure Storage (R-Recreation)
- SCS / Corps of Engr. — Multiple Purpose Flood Prevention and Agricultural Water Management Ditch
- (2) Structure Site Number
- Drainage Area Controlled by Structure
- Benefited Area
- Benefited Area Affected by Black River Backwater

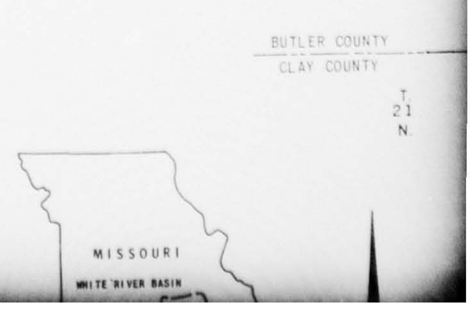
No.	Watershed	Watershed *Drainage Area (Sq. Mi.)
52	North Inter-River Drainage Dist.	155
53	Cane Creek - Black River Mainstem	343

* Preliminary Data

(53)

CANE CREEK - BLACK RIVER MAINSTEM

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	685	12	2.182	23	768
2	1,683	13	704	24	1.363
3	3,021	14	512	25	832
4	1,498	15	749	26	1.370
5	1,510	16	877	27	2.317
6	4,640	17	2.035	28	1.414
7	902	18	806	29	1.350
8	589	19	499	30	557
9	12,122	20	11.193	31	2.048
10	4,006	21	3.245	32	2,368
11	774	22	998	33	2,707



Benefited Area Affected by Black River Backwater

2

(53)

CANE CREEK - BLACK RIVER MAINSTEM

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	685	12	2,182	23	768
2	1,683	13	704	24	1,363
3	3,021	14	512	25	832
4	1,498	15	749	26	1,370
5	1,510	16	877	27	2,317
6	4,640	17	2,035	28	1,414
7	902	18	806	29	1,350
8	589	19	499	30	557
9	12,122	20	11,193	31	2,048
10	4,006	21	3,245	32	2,368
11	774	22	998	33	2,707

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
CANE CREEK - BLACK RIVER MAINSTEM - - - - WATERSHED NO. 53							
1	1.700	11	1.900	18	2.000	26	3.300
3	2.100	12	4.900	19	1.200	27	5.600
4	3.600	13	1.700	20	2.000	28	300
5	3.700	14	1.300	22	2.300	29	3.300
7	1.900	15	1.900	23	1.900	33	1.600
8	1.500	16	2.200	24	3.300		
9	3.800	17	5.000	25	2.100		

BUTLER COUNTY

CLAY COUNTY

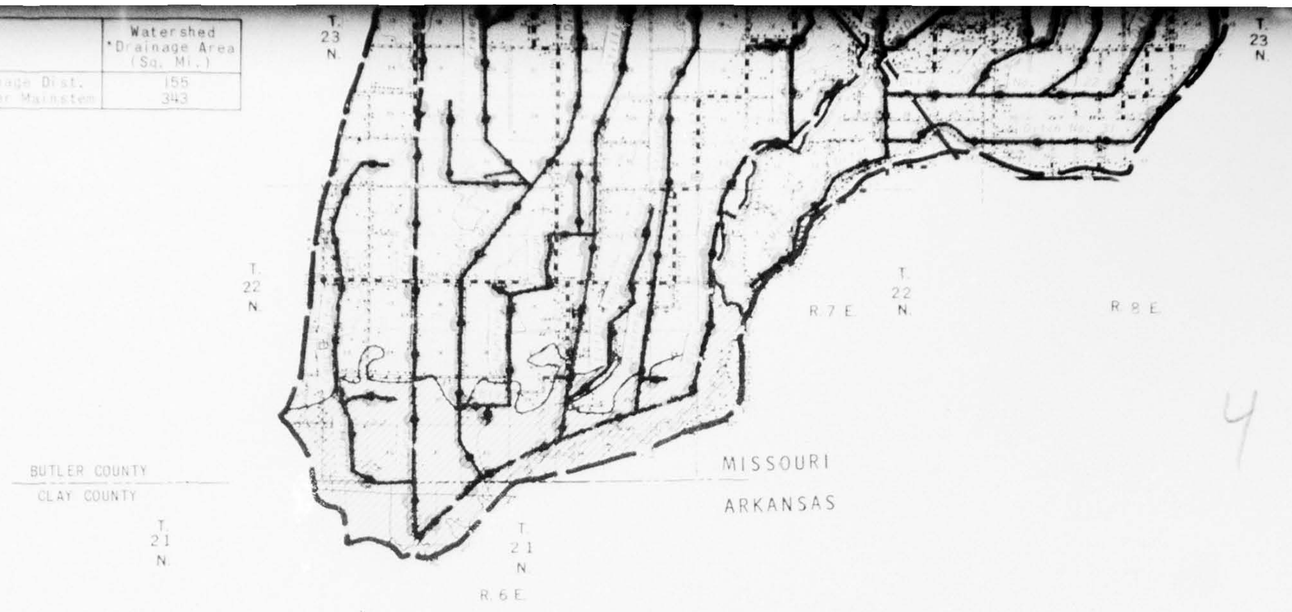
T. 21 N

N

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN

No.	Watershed	Watershed *Drainage Area (Sq. Mi.)
52	North Inter-River Drainage Dist.	155
53	Cane Creek - Black River Mainstem	343

* Preliminary Data



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POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN

COMPREHENSIVE STUDY

BLACK RIVER-POPLAR BLUFF TO BELOW MOUTH OF CANE CREEK

REACH NO. 14

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

1 0 1 2 3 4
MILES

APPROXIMATE DRAINAGE AREA 498 SQUARE MILES

Rev. 3-68 4-R-21220

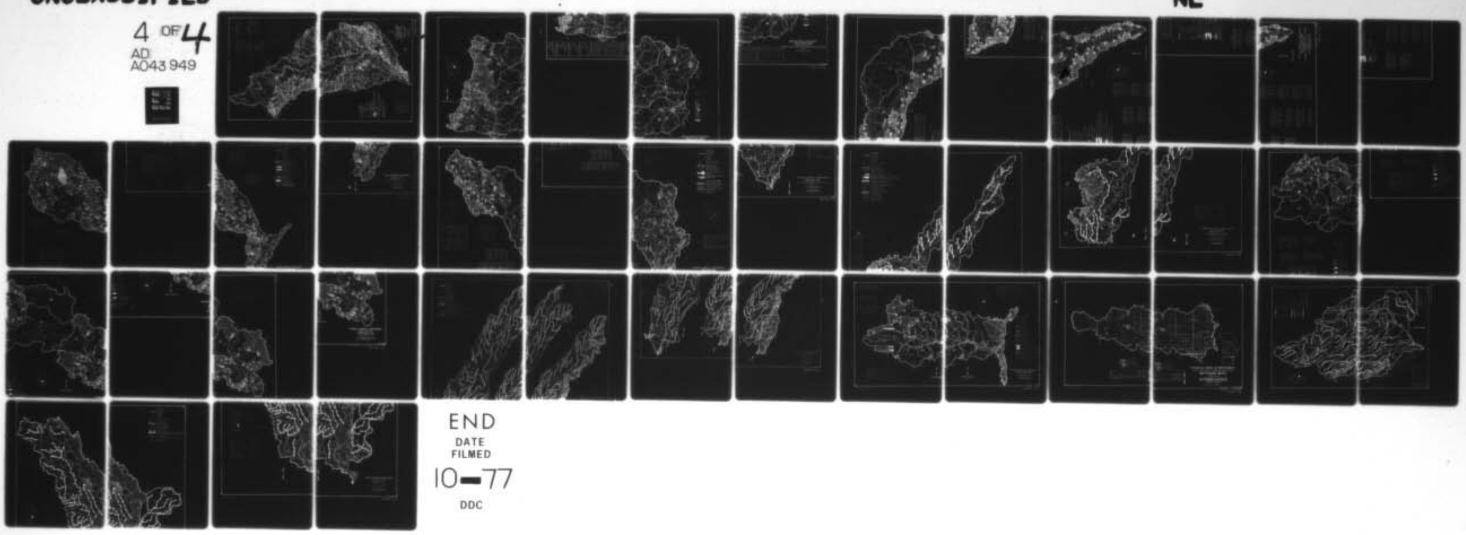
Rev. 9-67 Base 4-R-19963

PLATE No. P-34

AD-A043 949 WHITE RIVER BASIN COORDINATING COMMITTEE F/G 8/6
COMPREHENSIVE BASIN STUDY. WHITE RIVER BASIN MISSOURI AND ARKAN--ETC(U)
JUN 68

UNCLASSIFIED NL

4 OF 4
AD
A043 949



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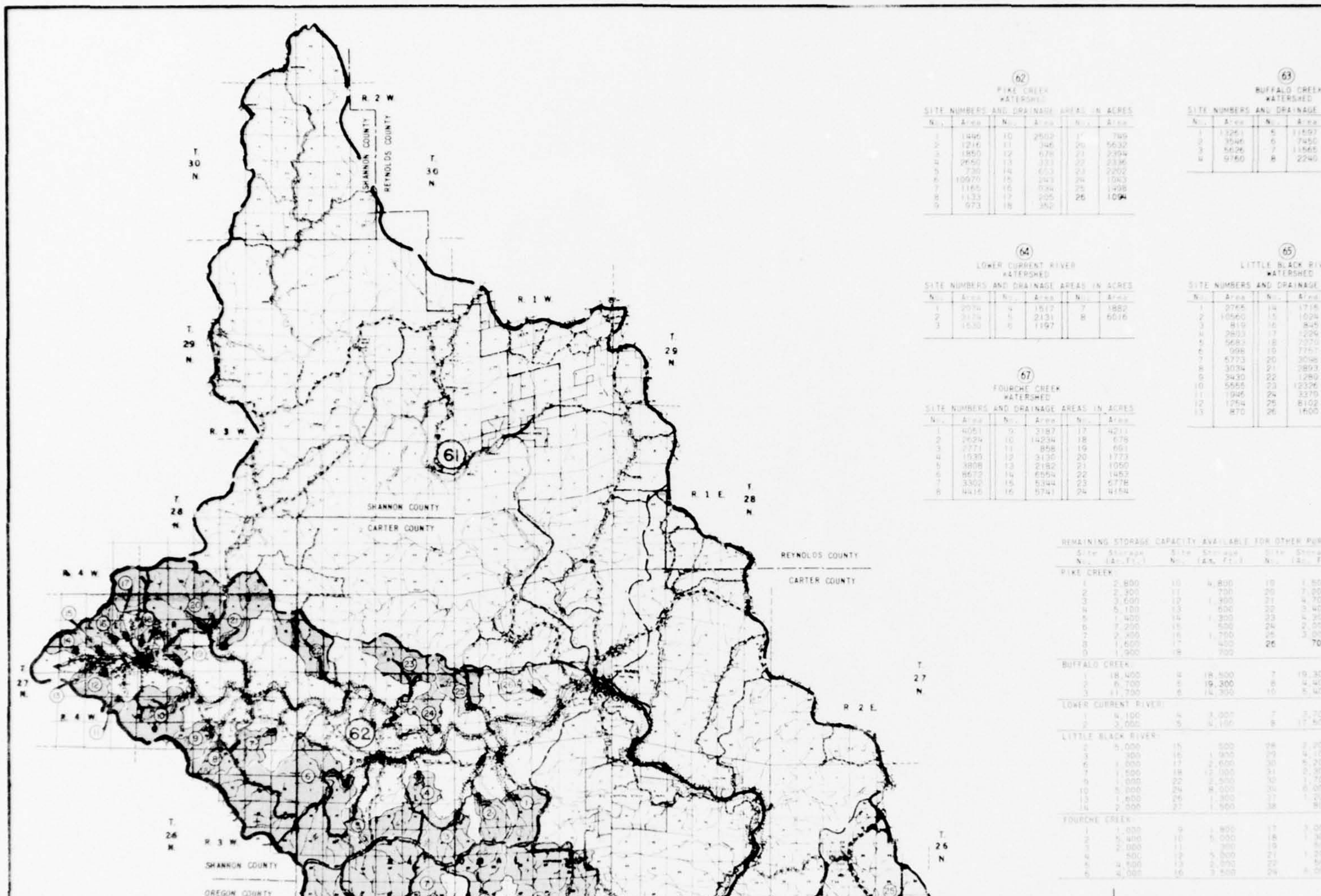


62

PIKE CREEK WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	1446	10	2502	19	789
2	1216	11	346	20	5632
3	1850	12	678	21	2394
4	2650	13	333	22	2336
5	730	14	653	23	2202
6	10970	15	243	24	1063
7	1165	16	534	25	1498
8	1133	17	205	26	1094
9	973	18	352		

63

BUFFALO CREEK WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	13261	5	11597	9	4026
2	3546	6	7450	10	2778
3	5626	7	11565		
4	9760	8	2240		

64

LOWER CURRENT RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	2074	4	1517	7	1882
2	3174	5	2131	8	6016
3	1530	6	1197		

65

LITTLE BLACK RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	2765	14	1716	27	1843
2	10560	15	1024	28	1088
3	819	16	845	29	1920
4	2803	17	1229	30	2381
5	5683	18	2270	31	1024
6	998	19	7757	32	819
7	6773	20	3096	33	13286
8	3034	21	2893	34	7219
9	3430	22	1280	35	1446
10	5555	23	12326	36	3162
11	1946	24	3370	37	832
12	1254	25	8102	38	1306
13	870	26	1600	39	2432

67

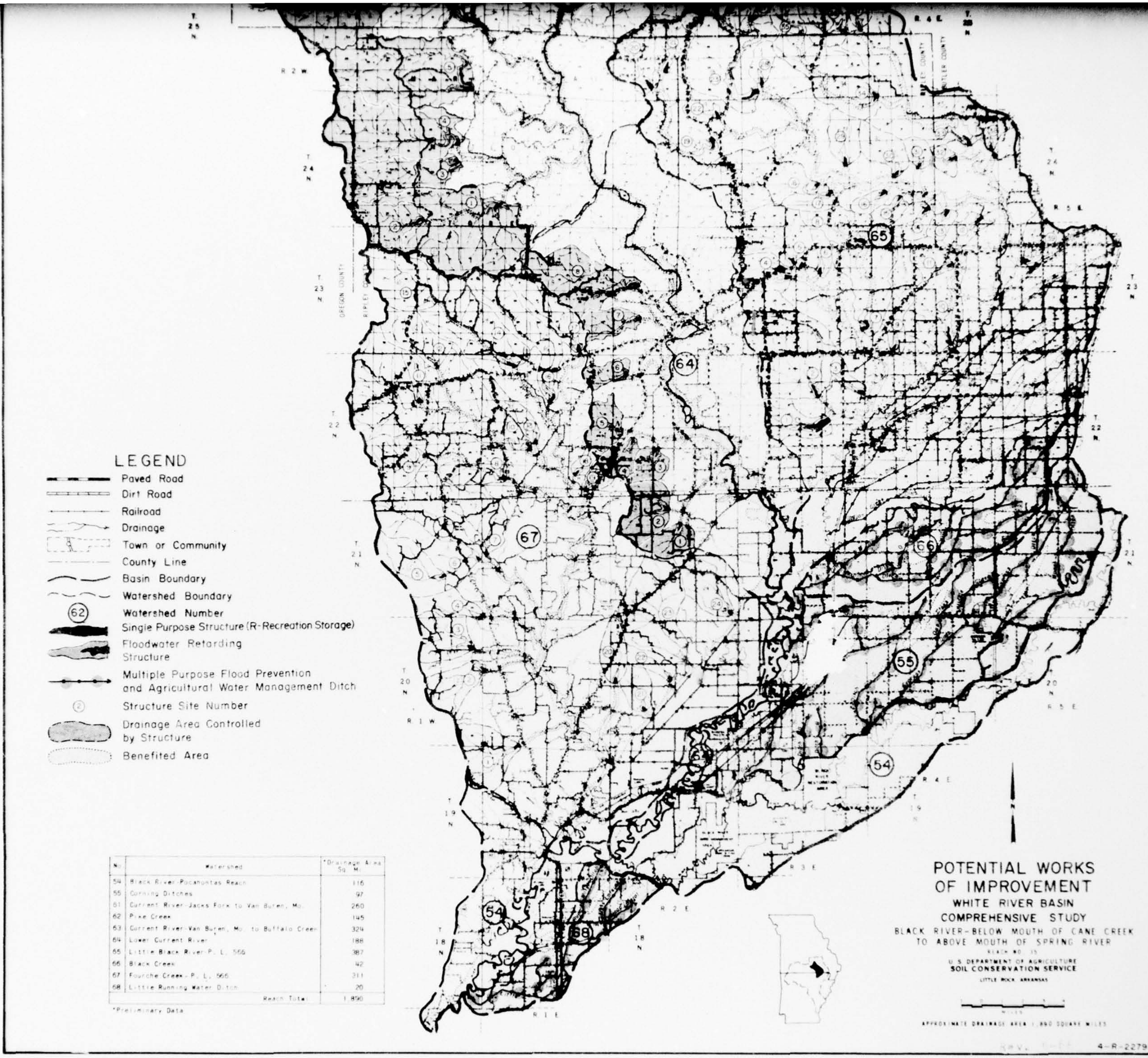
FOURCHE CREEK WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	4051	9	3187	17	4211
2	2624	10	14234	18	678
3	2771	11	858	19	661
4	1530	12	3130	20	1773
5	3808	13	2182	21	1050
6	8672	14	6554	22	1457
7	3302	15	5344	23	6778
8	4416	16	5741	24	4154

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
PIKE CREEK					
1	2,800	10	4,800	19	1,500
2	2,300	11	700	20	7,000
3	3,600	12	1,300	21	4,700
4	5,100	13	600	22	3,400
5	1,400	14	1,300	23	4,200
6	7,200	15	500	24	2,000
7	2,300	16	1,700	25	3,000
8	1,600	17	400	26	700
9	1,900	18	700		
BUFFALO CREEK					
1	18,400	4	18,500	7	19,300
2	6,700	5	19,300	8	4,400
3	11,700	6	14,300	10	5,400
LOWER CURRENT RIVER					
1	4,100	4	3,007	7	3,700
2	2,000	5	4,100	8	17,500
LITTLE BLACK RIVER					
2	5,000	15	500	28	2,200
3	300	16	1,900	29	4,100
6	1,000	17	2,600	30	5,200
7	1,500	18	12,000	31	2,300
9	1,000	22	2,500	32	1,700
10	5,000	24	8,000	36	6,000
13	1,600	26	1,300	37	1,200
14	2,000	27	1,500	38	800
FOURCHE CREEK					
1	1,000	9	1,800	17	3,000
2	5,400	10	5,000	18	1,300
3	2,000	11	300	19	800
4	800	12	5,000	21	1,700
5	4,500	13	2,070	22	500
6	4,000	16	3,500	24	6,000

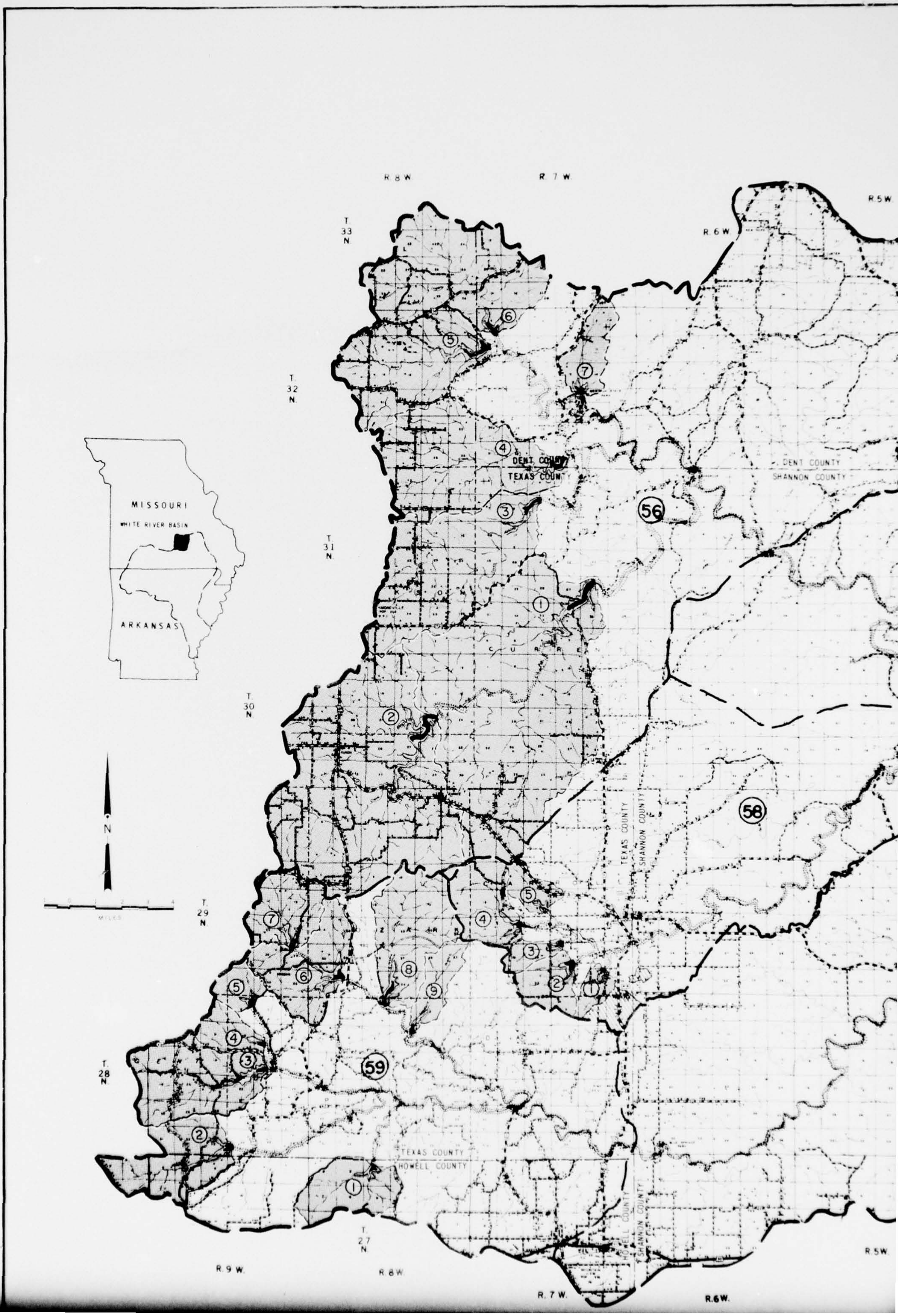


No.	Watershed	*Drainage Area Sq. Mi.
54	Black River-Pocahontas Reach	116
55	Corning Ditches	97
61	Current River-Jacks Fork to Van Buren, Mo.	260
62	Pike Creek	145
63	Current River-Van Buren, Mo. to Buffalo Creek	324
64	Lower Current River	188
65	Little Black River-P. L. 566	387
66	Black Creek	42
67	Fourche Creek-P. L. 566	311
68	Little Running Water Ditch	20
	Reach Total	1,890

*Preliminary Data

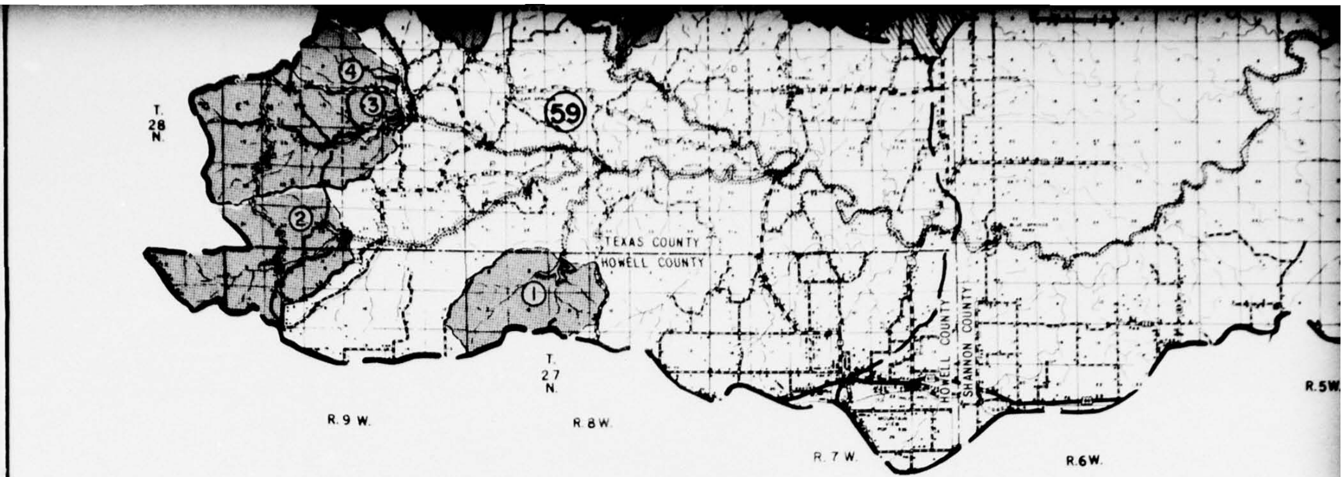
Rev 9-66 4-R-19996

PLATE No. P-35



R.8W.
R.7W.
R.6W.
R.5W.
T. 33 N
T. 32 N
T. 31 N
T. 30 N
T. 29 N
T. 28 N
T. 27 N
MISSOURI
WHITE RIVER BASIN
ARKANSAS
N
MILES
DENT COUNTY
TEXAS COUNTY
SHANNON COUNTY
HOWELL COUNTY
56
58
59
R.9W.
R.8W.
R.7W.
R.6W.
R.5W.

2



(56) UPPER CURRENT RIVER WATERSHED

Site Number	Drainage Area-Acres
1	34,118
2	29,664
3	14,835
4	13,075
5	10,413
6	13,165
7	3,034

(57) CURRENT RIVER-AKERS TO JACKS FORK WATERSHED

Site Number	Drainage Area-Acres
1	3,824
2	1,900
3	2,927

58 SPRING VALLEY CREEK WATERSHED

Site Number	Drainage Area-Acres
1	1,030
2	2,470
3	1,094
4	4,141
5	1,338

(59) UPPER JACKS FORK WATERSHED

Site Number	Drainage Area-Acres
1	4,275
2	6,733
3	8,006
4	2,016
5	1,472
6	6,336
7	3,904
8	7,443
9	2,183

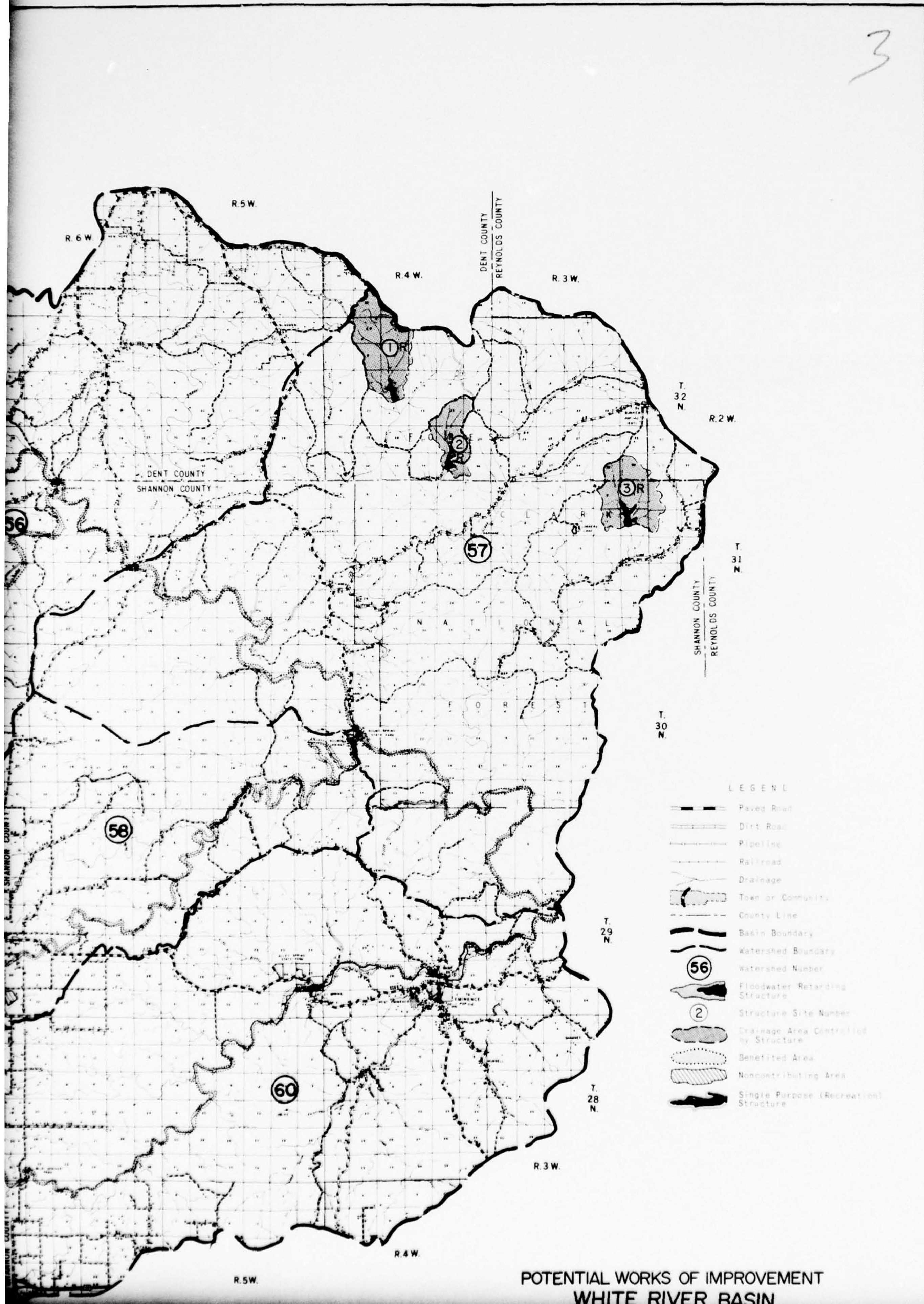
REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
UPPER CURRENT RIVER:						5	19,500
1	10,700	3	17,200	4	4,700	6	1,300
CURRENT RIVER-AKERS TO JACKS FORK:							
1	6,300	2	3,100	3	4,000		
SPRING VALLEY CREEK:							
1	2,000	2	4,800	3	2,200	5	2,600
UPPER JACKS FORK:							
1	8,800	4	4,200	8	4,100		

No.	
56	Upper Cu
57	Current
58	Spring
	Jacks
59	Uppe
60	Lowe

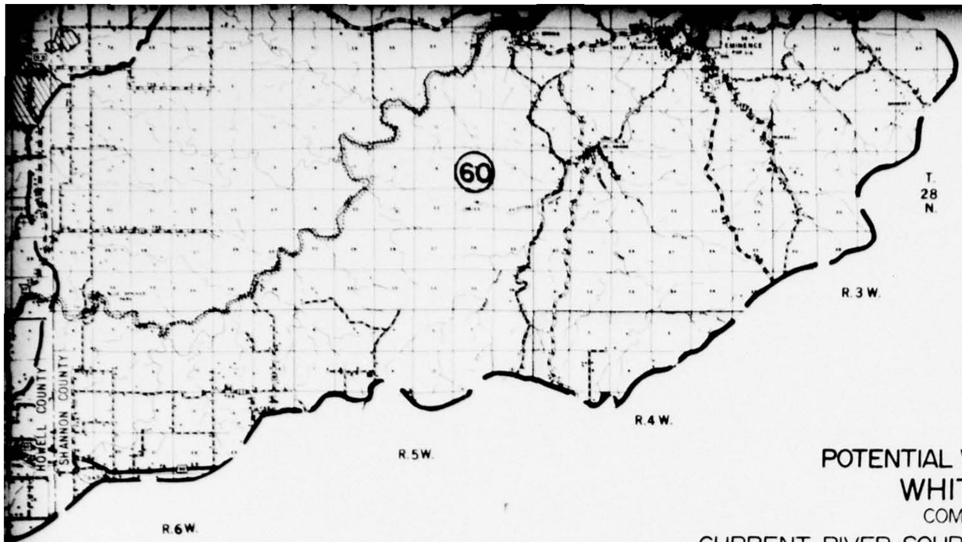
*Preliminary

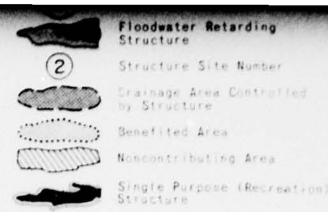
Base from General Highway Map - 1961 and 1963 - Reproduction permission granted U. S. Department of Agriculture, Soil Conservation Service, Fort Worth, Texas.



POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN





PACITY AVAILABLE FOR OTHER PURPOSES				
Storage Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
17,200	4	4,700	5 6	19,500 1,300
JACKS FORK: 3,100	3	4,000		
4,800	3	2,200	5	2,600
4,200	8	4,100		

No.	Watershed	*Drainage Area (Sq. Mi.)
56	Upper Current River	377
57	Current R.-Akers to Jack Fork	307
58	Spring Valley Creek	145
	Jacks Fork Creek	
59	Upper Jacks Fork	189
60	Lower Jacks Fork	249

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
CURRENT RIVER-SOURCE TO BELOW MOUTH OF JACKS FORK

REACH 16

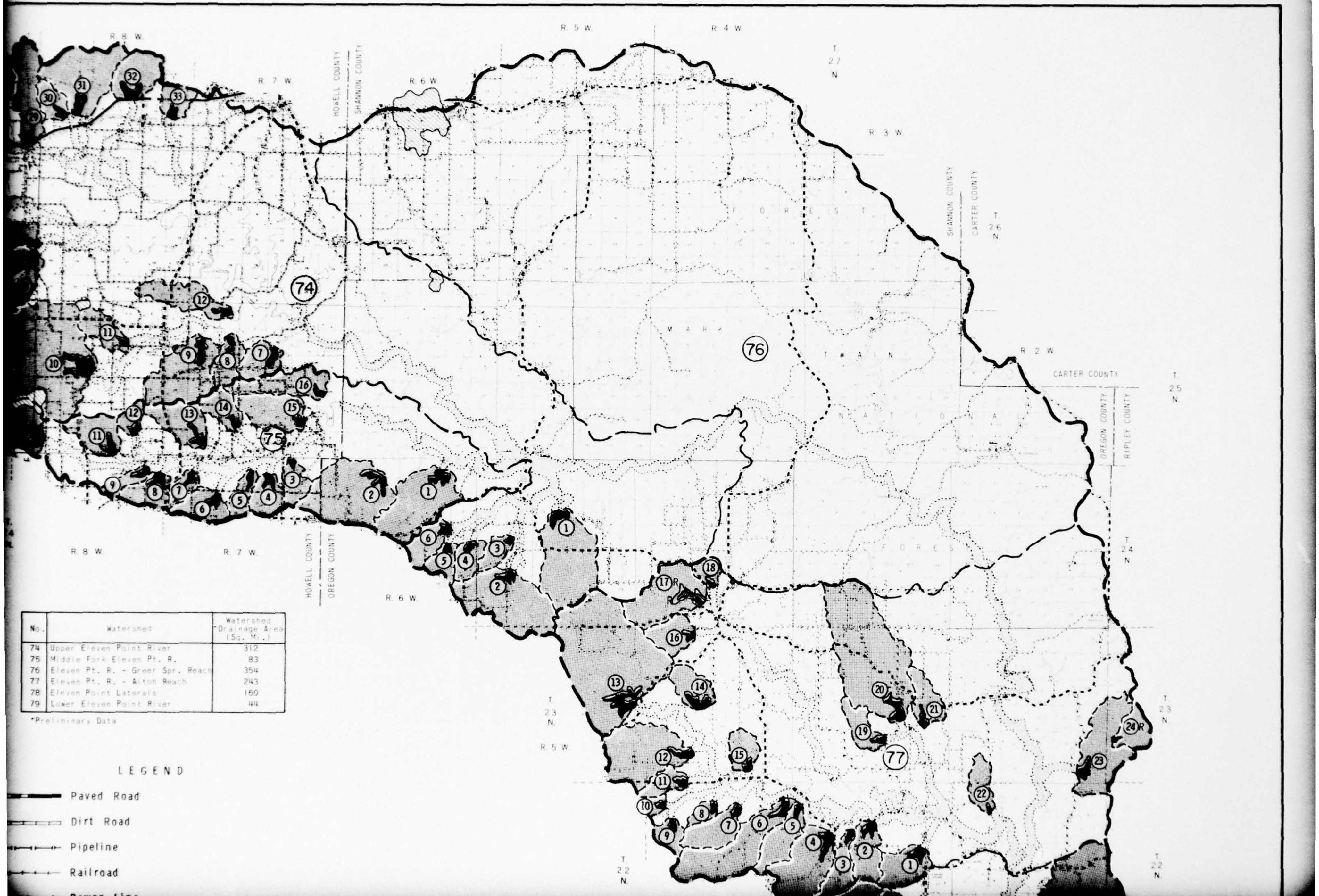
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

LITTLE ROCK, ARKANSAS

Rev. 3-68 4-R-22755

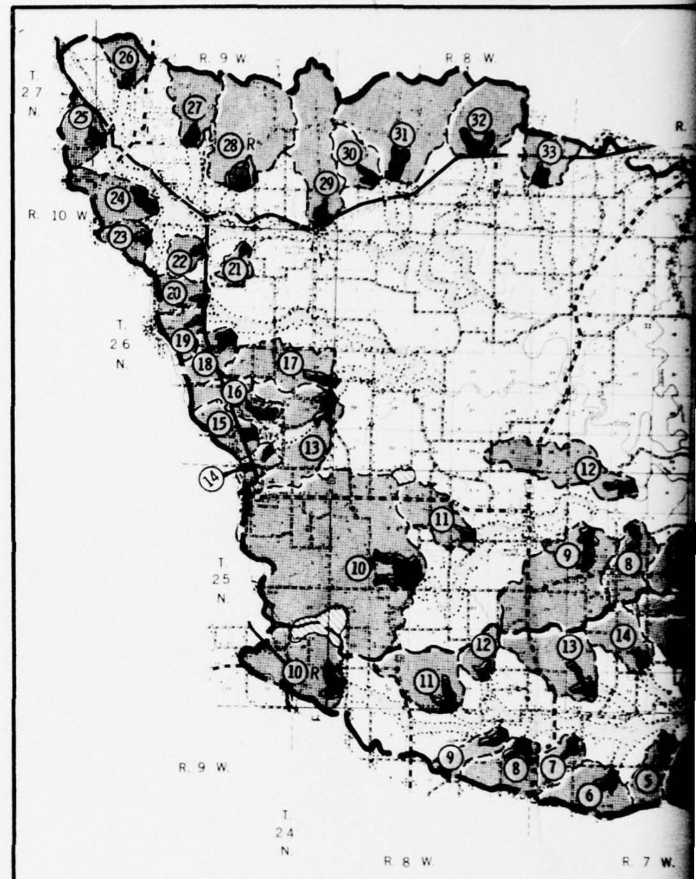
4-R-19967

PLATE No. P-36



No.	Watershed	Watershed *Drainage Area (Sq. Mi.)
74	Upper Eleven Point River	312
75	Middle Fork Eleven Pt. R.	83
76	Eleven Pt. R. - Greer Spr. Reach	354
77	Eleven Pt. R. - Alton Reach	243
78	Eleven Point Laterals	160
79	Lower Eleven Point River	44

*Preliminary Data



No.	Watershed	Watershed *Drainage (Sq. Mi.)
74	Upper Eleven Point River	312
75	Middle Fork Eleven Pt. R.	83
76	Eleven Pt. R. - Greer Spr. Reach	354
77	Eleven Pt. R. - Alton Reach	243
78	Eleven Point Laterals	160
79	Lower Eleven Point River	44

*Preliminary Data

LEGEND

Paved Road

Dirt Road

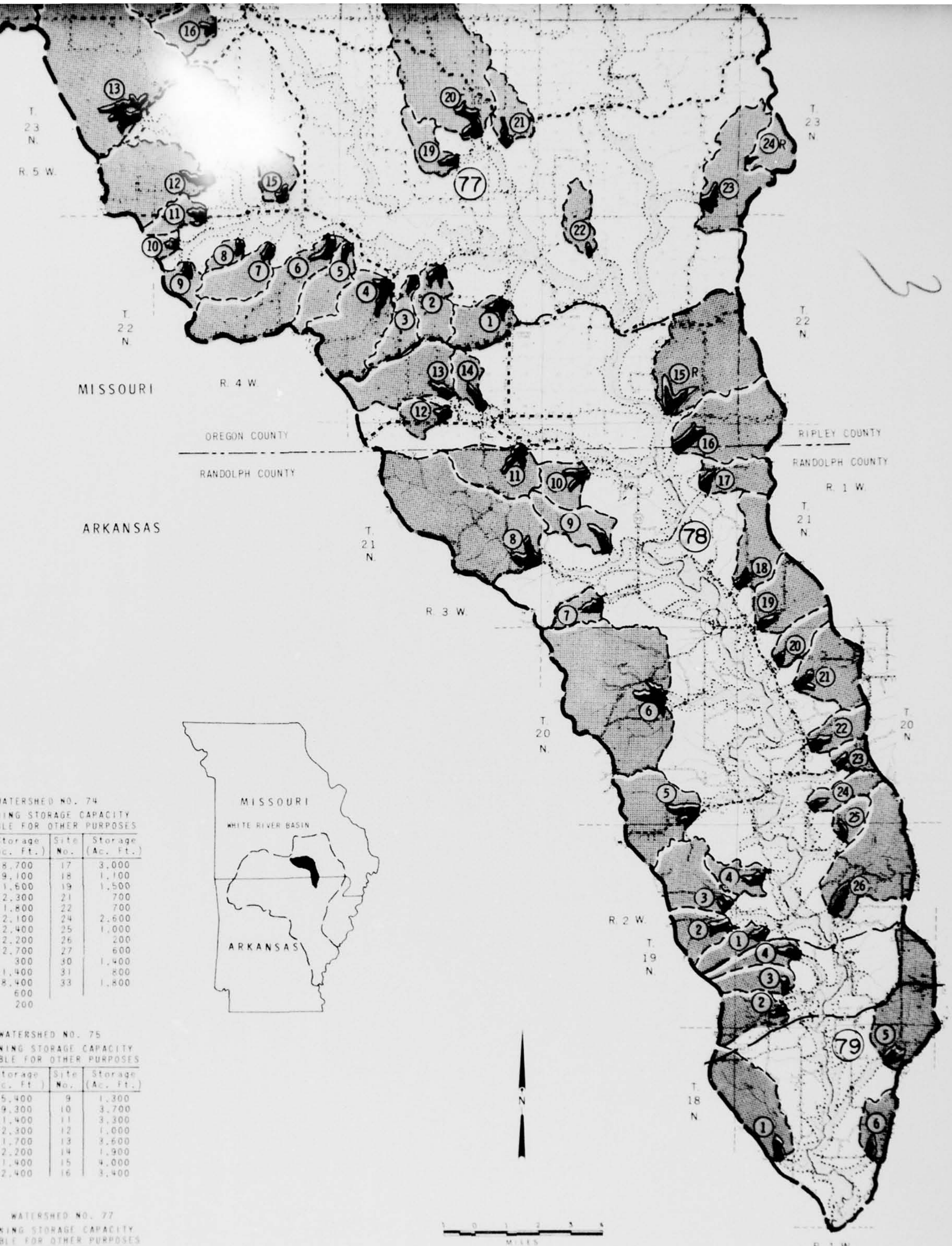
Pipeline

No.	Watershed	Watershed *Drainage Area (Sq. Mi.)
74	Upper Eleven Point River	312
75	Middle Fork Eleven Pt. R.	83
76	Eleven Pt. R. - Greer Spr. Reach	354
77	Eleven Pt. R. - Alton Reach	243
78	Eleven Point Laterals	160
79	Lower Eleven Point River	44

*Preliminary Data

LEGEND

- Paved Road
- Dirt Road
- Pipeline
- Railroad
- Power Line
- Drainage
- Town or Community
- County Line
- (75) Watershed Number
- Watershed Boundary
- Basin Boundary
- Floodwater Retarding Structure
- Multiple Purpose Structure R-Recreation
- Single Purpose Structure (R-Recreation)
- (18) Structure Site Number
- Drainage Area Controlled by Structure
- Benefited Area
- Non-Contributing Areas



...ED NO. 78
...AINAGE AREAS IN ACRES

Area	No.	Area
2,227	19	1,996
1,126	20	947
800	21	1,536
2,912	22	768
749	23	256
5,120	24	858
3,872	25	640
1,459	26	4,608
2,150		

...HED NO.78
...STORAGE CAPACITY
...OR OTHER PURPOSES

...ge (...t.)	Site No.	Storage (Ac. Ft.)
...00	17	2,800
...00	18	4,200
...00	20	1,800
...00	22	1,400
...00	23	500
...00	24	1,700
...00	25	1,200
...00	26	3,000

WATERSHED NO. 74
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	4,640	12	1,779	23	582
2	4,614	13	2,828	24	1,306
3	819	14	320	25	838
4	1,197	15	749	26	435
5	909	16	1,037	27	1,094
6	1,101	17	1,510	28	2,829
7	1,242	18	819	29	2,272
8	1,107	19	755	30	768
9	3,398	20	678	31	3,354
10	9,094	21	352	32	1,824
11	1,190	22	371	33	992

WATERSHED NO. 75
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	3,968	7	845	12	538
2	4,730	8	1,235	13	1,875
3	710	9	659	14	979
4	1,158	10	2,074	15	2,061
5	890	11	1,683	16	1,715
6	1,133				

WATERSHED NO. 77
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	1,747	9	749	17	3,123

WATERSHED NO. 74
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	8,700	17	3,000
2	9,100	18	1,100
3	1,600	19	1,500
4	2,300	21	700
5	1,800	22	700
6	2,100	24	2,600
7	2,400	25	1,000
8	2,200	26	200
9	2,700	27	600
11	300	30	1,400
12	1,400	31	800
13	8,400	33	1,800
14	600		
16	200		

WATERSHED NO. 75
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	5,400	9	1,300
2	9,300	10	3,700
3	1,400	11	3,300
4	2,300	12	1,000
5	1,700	13	3,600
6	2,200	14	1,900
7	1,400	15	4,000
8	2,400	16	3,400

WATERSHED NO. 77
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	3,400	11	1,900
2	1,900	12	7,500
3	2,600	13	5,200
[illegible]	[illegible]	[illegible]	2,700

4

No.	Watershed	*Dr
74	Upper Eleven Point River	
75	Middle Fork Eleven Pt. R.	
76	Eleven Pt. R. - Greer Spr. Reach	
77	Eleven Pt. R. - Alton Reach	
78	Eleven Point Laterals	
79	Lower Eleven Point River	

*Preliminary Data

LEGEND

- Paved Road
- Dirt Road
- Pipeline
- Railroad
- Power Line
- Drainage
- Town or Community
- County Line
- 75 Watershed Number
- Watershed Boundary
- Basin Boundary
- Floodwater Retarding Str
- Multiple Purpose Structu
- Single Purpose Structur
- 18 Structure Site Number
- Drainage Area Controlle
- Benefited Area
- Non-Contributing Areas

WATERSHED NO. 78
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	819	10	2,227	19	1,996
2	1,350	11	1,126	20	947
3	2,598	12	800	21	1,536
4	742	13	2,912	22	768
5	3,244	14	749	23	256
6	8,627	15	5,120	24	858
7	819	16	3,872	25	640
8	9,408	17	1,459	26	4,608
9	1,843	18	2,150		

WATERSHED NO. 78
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	1,400	17	2,800
4	200	18	4,200
5	2,600	20	1,800
8	17,700	22	1,400
11	2,000	23	500
12	1,500	24	1,700
13	3,200	25	1,200

NO. 78
AGE AREAS IN ACRES

ea	No.	Area
227	19	1,996
126	20	947
800	21	1,536
912	22	768
749	23	256
120	24	858
872	25	640
459	26	4,608
150		

NO.78
AGE CAPACITY
OTHER PURPOSES

Site No.	Storage (Ac. Ft.)
17	2,800
18	4,200
20	1,800
22	1,400
23	500
24	1,700
25	1,200
26	3,000

WATERSHED NO. 74
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	4,640	12	1,779	23	582
2	4,614	13	2,828	24	1,306
3	819	14	320	25	838
4	1,197	15	749	26	435
5	909	16	1,037	27	1,094
6	1,101	17	1,510	28	2,829
7	1,242	18	819	29	2,272
8	1,107	19	755	30	768
9	3,398	20	678	31	3,354
10	9,094	21	352	32	1,824
11	1,190	22	371	33	992

WATERSHED NO. 75
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	3,968	7	845	12	538
2	4,730	8	1,235	13	1,875
3	710	9	659	14	979
4	1,158	10	2,074	15	2,061
5	890	11	1,683	16	1,715
6	1,133				

WATERSHED NO. 77
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	1,747	9	749	17	3,123
2	1,370	10	314	18	654
3	1,421	11	947	19	998
4	3,475	12	3,878	20	7,213
5	1,613	13	9,702	21	1,344
6	3,738	14	1,389	22	1,069
7	1,651	15	979	23	4,333
8	474	16	1,267	24	1,011

WATERSHED NO. 79
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	2,893	3	896	5	3,456
2	1,664	4	1,030	6	1,050

WATERSHED NO. 74
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	8,700	17	3,000
2	9,100	18	1,100
3	1,600	19	1,500
4	2,300	21	700
5	1,800	22	700
6	2,100	24	2,600
7	2,400	25	1,000
8	2,200	26	200
9	2,700	27	600
11	300	30	1,400
12	1,400	31	800
13	8,400	33	1,800
14	600		
16	200		

WATERSHED NO. 75
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	5,400	9	1,300
2	9,300	10	3,700
3	1,400	11	3,300
4	2,300	12	1,000
5	1,700	13	3,600
6	2,200	14	1,900
7	1,400	15	4,000
8	2,400	16	3,400

WATERSHED NO. 77
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	3,400	11	1,900
2	1,900	12	7,500
3	2,600	13	5,200
4	6,500	14	2,700
5	3,000	15	1,100
6	2,000	16	700
7	3,300	19	200
8	1,000	21	200
9	1,500	22	100
10	600	23	8,400
		24	1,100

WATERSHED NO.79
REMAINING STORAGE CAPACITY
AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	5,500	4	1,800
3	1,800	6	2,000

POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
ELEVEN POINT RIVER - SOURCE TO MOUTH
REACH No. 17
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Revised 3-68 4-R-22997
Revised 8-67 Base 4-R-19995

PLATE No. P-37

Floodwater Retarding Structure

Multiple Purpose Structure R-Recreation

Single Purpose Structure (R-Recreation)

(18) Structure Site Number

Drainage Area Controlled by Structure

Benefited Area

Non-Contributing Areas

WATERSHED NO. 78

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	819	10	2,227	19	1,996
2	1,350	11	1,126	20	947
3	2,598	12	800	21	1,536
4	742	13	2,912	22	768
5	3,244	14	749	23	256
6	8,627	15	5,120	24	858
7	819	16	3,872	25	640
8	9,408	17	1,459	26	4,608
9	1,843	18	2,150		

WATERSHED NO.78

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	1,400	17	2,800
4	200	18	4,200
5	2,600	20	1,000
8	17,700	22	1,400
11	2,000	23	500
12	1,500	24	1,700
13	3,200	25	1,200
15	5,300	26	3,000

WATERSHED NO. 74

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	4,640	12	1,779	23	582
2	4,614	13	2,828	24	1,306
3	819	14	320	25	838
4	1,197	15	749	26	435
5	909	16	1,037	27	1,094
6	1,101	17	1,510	28	2,829
7	1,242	18	819	29	2,272
8	1,107	19	755	30	768
9	3,398	20	678	31	3,354
10	9,094	21	352	32	1,824
11	1,190	22	371	33	992

WATERSHED NO. 75

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	3,968	7	845	12	538
2	4,730	8	1,235	13	1,875
3	710	9	659	14	979
4	1,158	10	2,074	15	2,061
5	890	11	1,683	16	1,715
6	1,133				

WATERSHED NO. 77

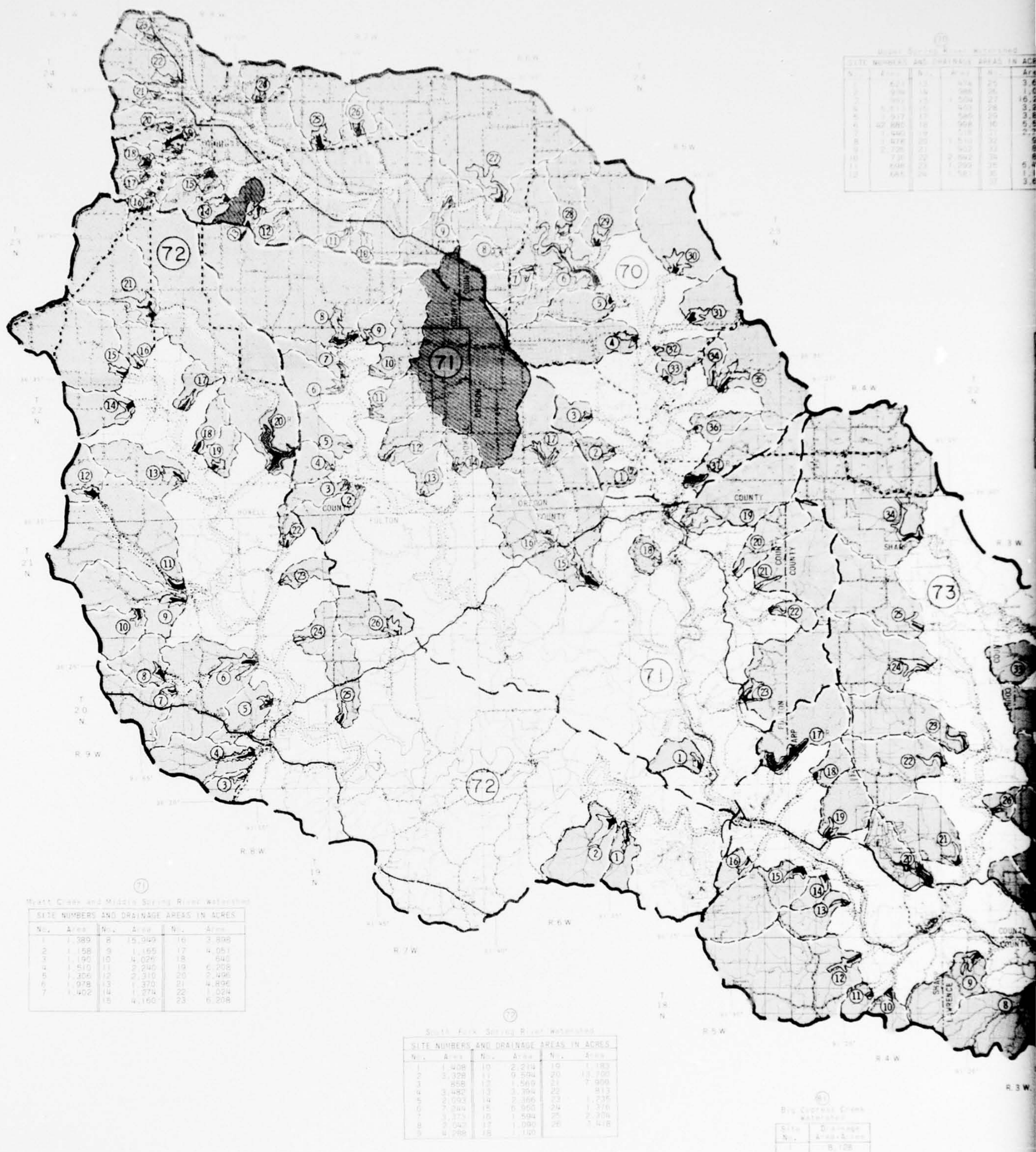
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	1,747	9	749	17	3,123
2	1,370	10	314	18	654
3	1,421	11	947	19	998
4	3,475	12	3,878	20	7,213
5	1,613	13	9,702	21	1,344
6	3,738	14	1,389	22	1,069
7	1,651	15	979	23	4,333
8	474	16	1,267	24	1,011

WATERSHED NO. 79

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	2,893	3	896	5	3,456
2	1,664	4	1,030	6	1,050



(70)

Upper Spring River watershed

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	627	13	474	25	3,6
2	934	14	988	26	1,0
3	993	15	1,504	27	16,2
4	5,613	16	452	28	3,2
5	2,917	17	540	29	3,8
6	42,880	18	958	30	5,5
7	1,440	19	518	31	[illegible]
8	1,878	20	1,510	32	[illegible]
9	2,726	21	952	33	[illegible]
10	710	22	2,842	34	[illegible]
11	608	23	1,290	35	5,4
12	665	24	1,583	36	1,
				37	3,6

(71)

Myatt Creek and Middle Spring River watershed

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	1,389	8	15,040	16	3,898
2	1,158	9	1,165	17	4,051
3	1,190	10	4,026	18	640
4	1,510	11	2,240	19	6,208
5	1,306	12	2,310	20	2,496
6	1,978	13	1,370	21	4,896
7	1,402	14	1,274	22	1,024
		15	4,160	23	6,208

(72)

South Fork Spring River watershed

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	1,408	10	2,214	19	1,183
2	3,328	11	9,594	20	13,700
3	858	12	1,569	21	7,908
4	3,482	13	3,394	22	813
5	2,093	14	2,366	23	1,235
6	7,244	15	6,950	24	1,376
7	3,375	16	1,594	25	2,304
8	2,047	17	1,090	26	1,418
9	4,288	18	1,120		

(81)

Big Cypress Creek watershed

Site No.	Drainage Area-Acres
1	8,128

(83)

Flat Creek watershed

P. L. 566 watershed in Place

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
UPPER SPRING RIVER:									
1	1,200	8	2,900	13	900	25	5,200	30	1,800
2	1,800	9	1,200	14	1,900	26	2,000	32	1,700
4	700	10	1,400	16	800	29	7,500	34	1,600
5	3,800	11	1,300	19	1,000	30	10,800	36	1,100
7	2,800	12	1,300	23	2,500	31	5,300		
MYATT CREEK AND MIDDLE SPRING RIVER:									
1	2,100	5	2,800	10	8,500	13	2,900	21	2,000
2	1,900	7	2,000	11	4,700	14	2,700	22	2,200
3	2,500	9	2,500	12	600	18	1,300	23	5,000
4	5,200								
SOUTH FORK SPRING RIVER:									
1	2,200	6	4,800	10	5,000	17	2,800	20	3,100
2	7,500	7	3,400	12	800	18	2,600	25	5,200
3	1,900	8	4,600	14	5,300	19	2,700		
5	4,700	9	2,700	16	700	21	100		
LOWER SPRING RIVER:									
4	2,300	12	3,000	18	2,300	24	2,200	30	1,600
5	600	13	3,000	19	5,600	25	1,000	31	1,000
9	4,500	14	2,300	21	7,800	27	1,600	32	4,000
10	1,900	15	4,000	22	4,000	28	2,000	35	4,300
11	1,300	16	4,000	23	4,000	29	2,000	36	1,000

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	2,093	14	2,366	23	1,235
6	7,244	15	6,950	24	1,376
7	3,373	16	1,594	25	2,304
8	2,042	17	1,090	26	3,418
9	4,288	18	1,140		

81

Big Cypress Creek Watershed

Site No.	Drainage Area-Acres
1	8,128

80

Flat Creek Watershed

P. L. 566 Watershed in Place

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
UPPER SPRING RIVER									
1	1,200	8	2,900	13	900	25	5,200	32	1,800
2	1,800	9	1,200	14	1,900	26	2,000	33	1,700
4	700	10	1,400	16	800	29	7,500	34	1,600
5	3,800	11	1,300	19	1,000	30	10,800	36	1,100
7	2,800	12	1,300	23	2,500	31	5,300		
MYATT CREEK AND MIDDLE SPRING RIVER									
1	2,900	5	2,800	10	8,500	13	2,900	21	2,000
2	2,400	7	2,000	11	4,700	14	2,700	22	2,200
3	2,500	9	2,500	12	600	18	1,300	23	5,000
4	7,200								
SOUTH FORK SPRING RIVER									
1	3,200	6	4,800	10	5,000	17	2,500	24	3,100
2	7,500	7	3,400	12	800	18	2,600	25	5,200
3	1,900	8	4,600	14	5,300	19	2,700		
5	4,700	9	2,700	16	300	23	100		
LOWER SPRING RIVER									
4	3,300	12	8,000	18	2,300	24	3,000	30	1,500
5	600	13	3,600	19	5,600	25	1,900	31	1,000
9	4,500	14	2,300	21	7,800	27	1,500	32	4,000
10	1,900	15	4,000	22	4,000	28	2,000	35	4,300
11	1,300	16	4,000	23	4,000	29	2,000	36	1,000

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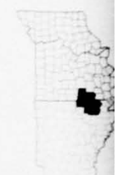
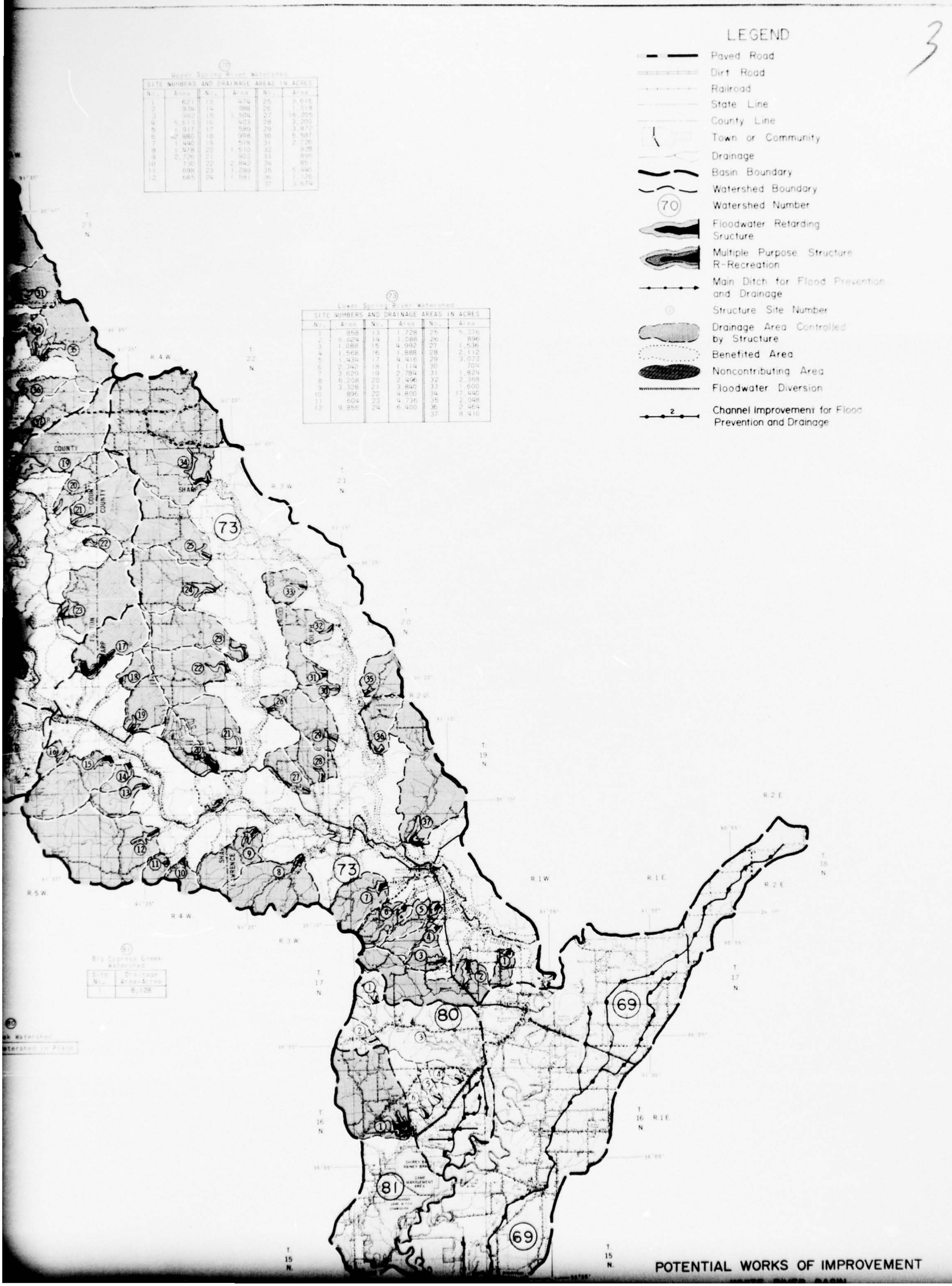
No.	Watershed	* Drainage Area (Sq. Mi.)
69	Big Running Water Ditch P. L. 566	125
70	Upper Spring River	259
71	Myatt Creek & Middle Spring River	281
72	South Fork Spring River	329
73	Lower Spring River	346
80	Flat Creek P. L. 566	37
81	Big Cypress Creek	43
	Reach Total	1420

* Preliminary Data.





3

Upper Spring River Watershed

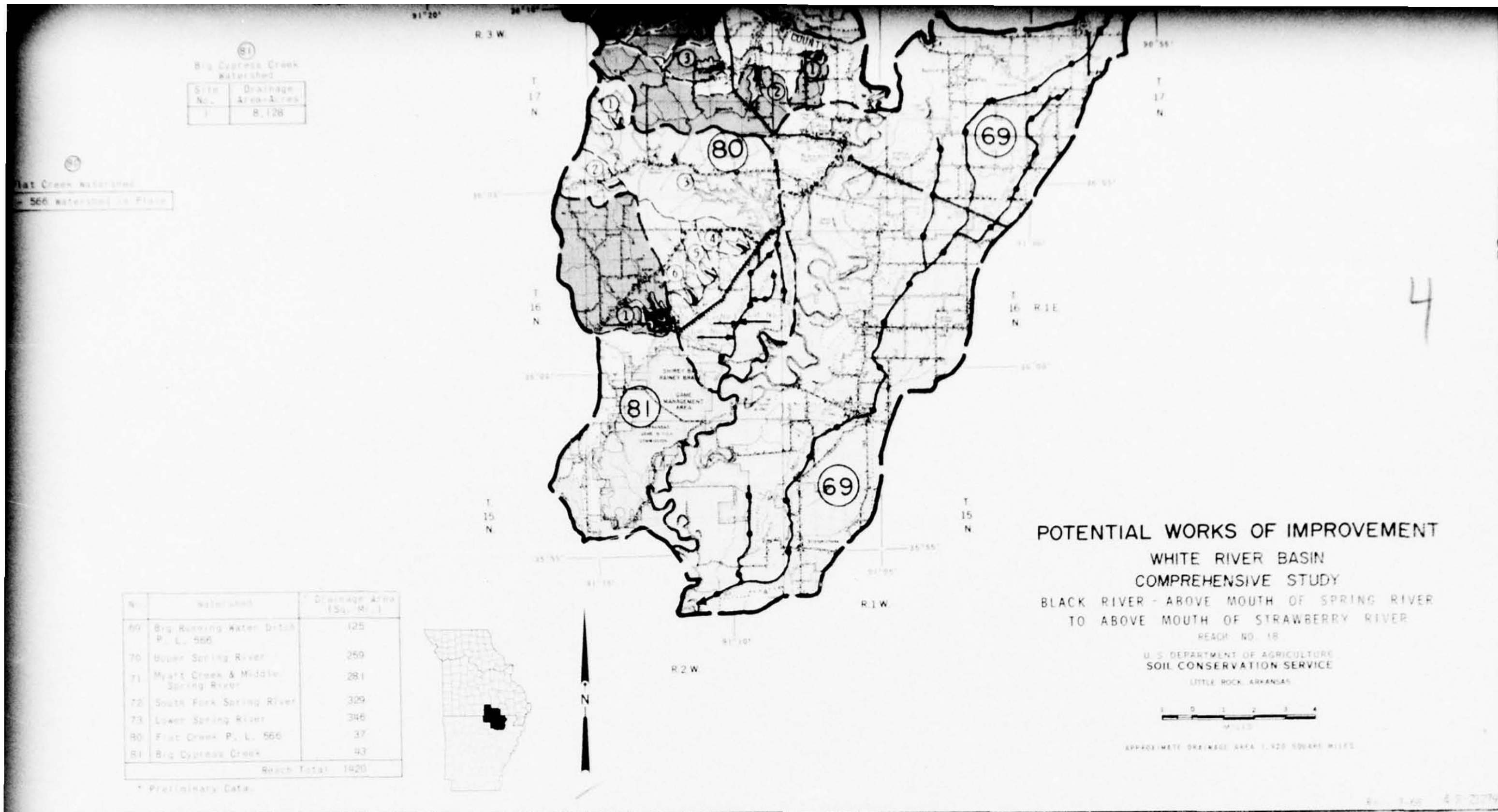
SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	621	13	474	25	3,616
2	938	14	088	26	1,018
3	992	15	1,504	27	16,205
4	5,613	16	403	28	3,200
5	1,917	17	589	29	3,872
6	2,880	18	998	30	5,587
7	1,440	19	519	31	2,726
8	1,478	20	1,510	32	928
9	2,726	21	903	33	896
10	730	22	2,842	34	851
11	698	23	1,299	35	5,446
12	685	24	1,581	36	1,126
				37	3,674

73

Lower Spring River Watershed

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	858	13	1,728	25	5,376
2	6,029	14	1,088	26	896
3	1,088	15	4,992	27	1,536
4	1,568	16	1,888	28	2,112
5	1,434	17	4,416	29	3,072
6	2,342	18	1,114	30	704
7	3,629	19	2,784	31	1,824
8	6,208	20	2,496	32	2,368
9	3,328	21	3,840	33	1,600
10	896	22	4,800	34	17,440
11	604	23	4,736	35	2,048
12	9,856	24	6,400	36	2,464
				37	8,416

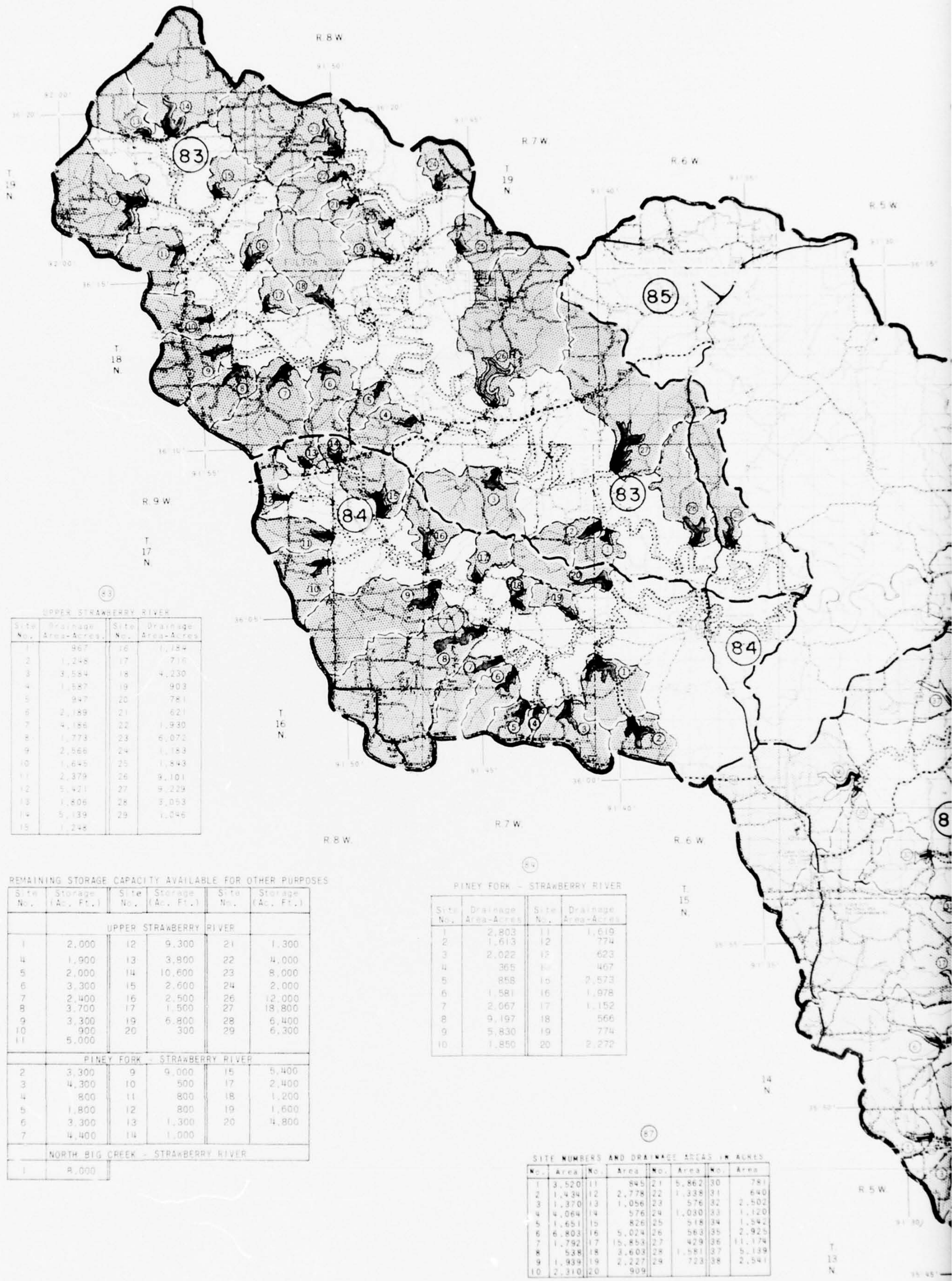
POTENTIAL WORKS OF IMPROVEMENT



No.	Watershed	Drainage Area (Sq. Mi.)
69	Big Running Water Ditch P. L. 566	125
70	Upper Spring River	259
71	Myatt Creek & Middle Spring River	281
72	South Fork Spring River	329
73	Lower Spring River	346
80	Flat Creek P. L. 566	37
81	Big Cypress Creek	43
	Reach Total	1420

* Preliminary Data.

PLATE No. P-38



83

UPPER STRAWBERRY RIVER

Site No.	Drainage Area-Acres	Site No.	Drainage Area-Acres
1	967	16	1,184
2	1,248	17	716
3	3,584	18	4,230
4	1,587	19	903
5	947	20	781
6	2,189	21	621
7	4,186	22	1,930
8	1,773	23	6,072
9	2,566	24	1,183
10	1,645	25	1,843
11	2,379	26	9,101
12	5,421	27	9,229
13	1,806	28	3,053
14	5,139	29	1,046
15	1,248		

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
	UPPER STRAWBERRY RIVER				
1	2,000	12	9,300	21	1,300
4	1,900	13	3,800	22	4,000
5	2,000	14	10,600	23	8,000
6	3,300	15	2,600	24	2,000
7	2,400	16	2,500	26	12,000
8	3,700	17	1,500	27	18,800
9	3,300	19	6,800	28	6,400
10	900	20	300	29	6,300
11	5,000				
	PINEY FORK - STRAWBERRY RIVER				
2	3,300	9	9,000	15	5,400
3	4,300	10	500	17	2,400
4	800	11	800	18	1,200
5	1,800	12	800	19	1,600
6	3,300	13	1,300	20	4,800
7	4,400	14	1,000		
	NORTH BIG CREEK - STRAWBERRY RIVER				
1	8,000				

84

PINEY FORK - STRAWBERRY RIVER

Site No.	Drainage Area-Acres	Site No.	Drainage Area-Acres
1	2,803	11	1,619
2	1,613	12	774
3	2,022	13	623
4	365	14	467
5	858	15	2,573
6	1,581	16	1,978
7	2,067	17	1,152
8	9,197	18	566
9	5,830	19	774
10	1,850	20	2,272

87

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area	No.	Area
1	3,520	11	845	21	5,862	30	781
2	1,434	12	2,778	22	1,338	31	640
3	1,370	13	1,056	23	576	32	2,502
4	4,064	14	576	24	1,030	33	1,120
5	1,651	15	826	25	518	34	1,542
6	6,803	16	5,024	26	563	35	2,925
7	1,792	17	15,853	27	429	36	11,174
8	538	18	3,603	28	1,581	37	5,139
9	1,939	19	2,227	29	723	38	2,541
10	2,310	20	909				

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	500	15	1,500	21	10,000	29	1,500	36	5,000
2	2,700	17	5,000	22	1,000	31	500	38	5,500
6	1,000	18	9,000	23	1,000	32	2,000		
11	300	19	5,500	24	2,300	33	2,200		
13	400	20	1,000	27	300	34	3,300		

3	4,300	10	500	17	2,400
4	800	11	800	18	1,200
5	1,800	12	800	19	1,600
6	3,300	13	1,300	20	4,800
7	4,400	14	1,000		
	NORTH BIG CREEK - STRAWBERRY RIVER				
1	8,000				

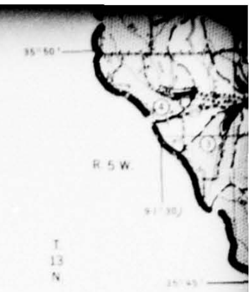
N.

2

87

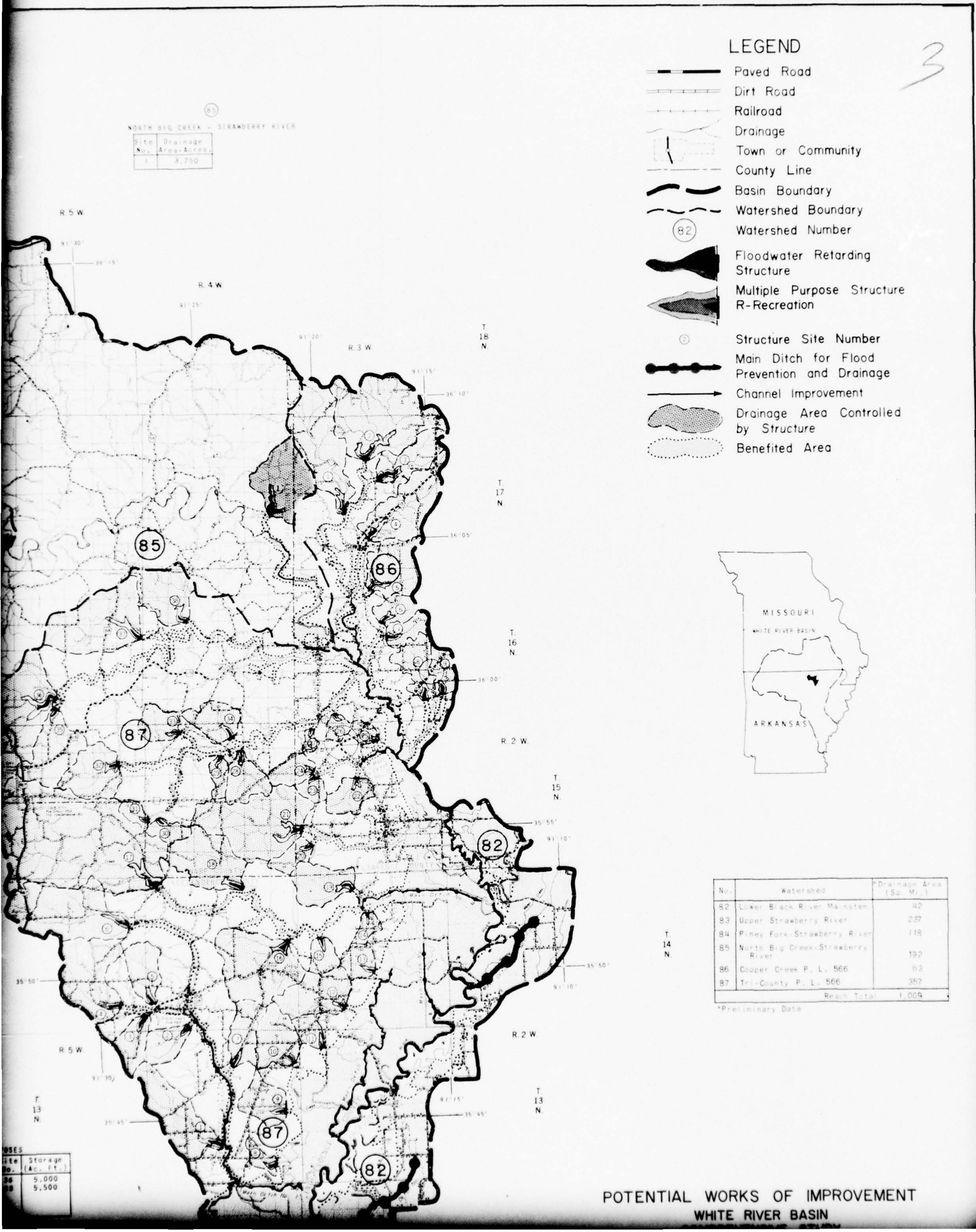
SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area	No.	Area
1	3,520	11	845	21	5,862	30	781
2	1,434	12	2,778	22	1,338	31	640
3	1,370	13	1,056	23	576	32	2,502
4	4,064	14	576	24	1,030	33	1,120
5	1,651	15	826	25	518	34	1,542
6	6,803	16	5,024	26	563	35	2,925
7	1,792	17	15,853	27	429	36	11,174
8	538	18	3,603	28	1,581	37	5,139
9	1,939	19	2,227	29	723	38	2,541
10	2,310	20	909				



REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
1	500	15	1,500	21	10,000	29	1,500	36	5,000
2	2,700	17	5,000	22	1,000	31	500	38	5,500
6	1,000	18	9,000	23	1,000	32	2,000		
11	300	19	5,500	24	2,300	33	2,200		
13	400	20	1,000	27	300	34	3,300		



No.	Watershed	*Drainage Area (Sq. Mi.)
82	Lower Black River Mainstem	42
83	Upper Strawberry River	237
84	Piney Fork-Strawberry River	118
85	North Big Creek-Strawberry River	192
86	Cooper Creek P. L. 566	63
87	Tri-County P. L. 566	357
	Reach Total	1,009

*Preliminary Data

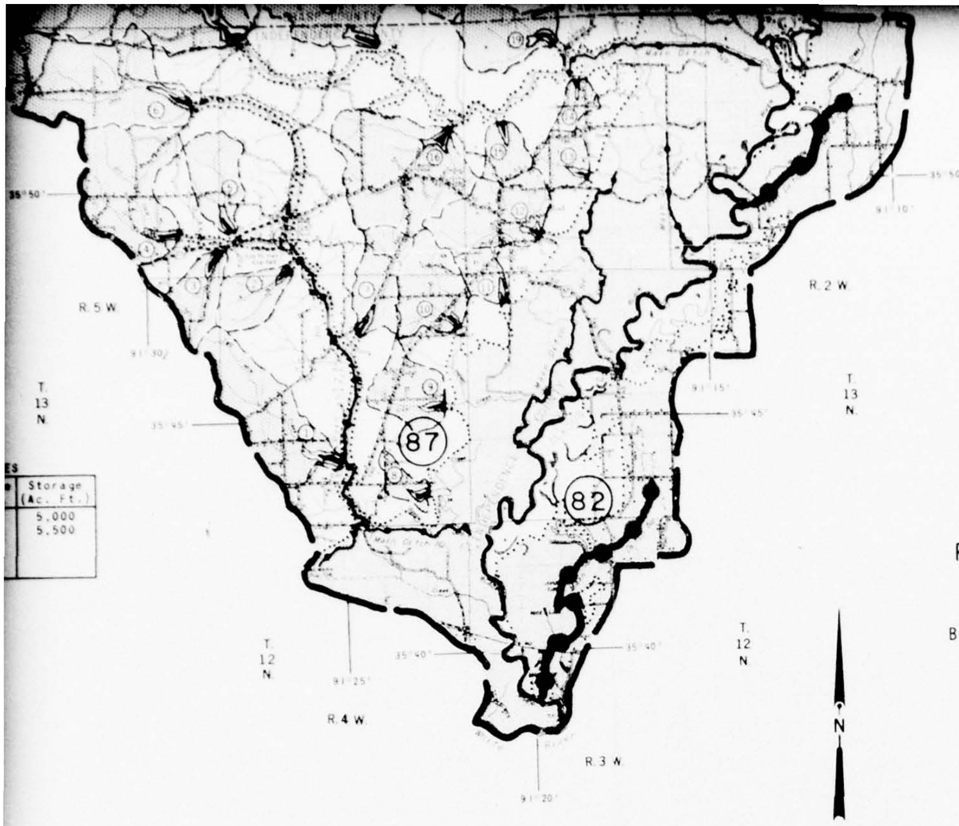
OSES

Site No.	Storage (Ac. Ft.)
36	5,000
38	5,500

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN

3



No.	Watershed	*Drainage Area (Sq. Mi.)
82	Lower Black River Mainstem	42
83	Upper Strawberry River	237
84	Piney Fork-Strawberry River	118
85	North Big Creek-Strawberry River	192
86	Cooper Creek P. L. 566	63
87	Tri-County P. L. 566	357
	Reach Total	1,009

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN COMPREHENSIVE STUDY

BLACK RIVER-ABOVE MOUTH OF STRAWBERRY RIVER TO WHITE RIVER

REACH NO. 19

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

1 0 1 2 3 4
MILES

APPROXIMATE DRAINAGE AREA 1,009 SQUARE MILES

Rev. 3-68 4-R-21333
Rev. 3-66 4-R-19595

PLATE No. P-39

4

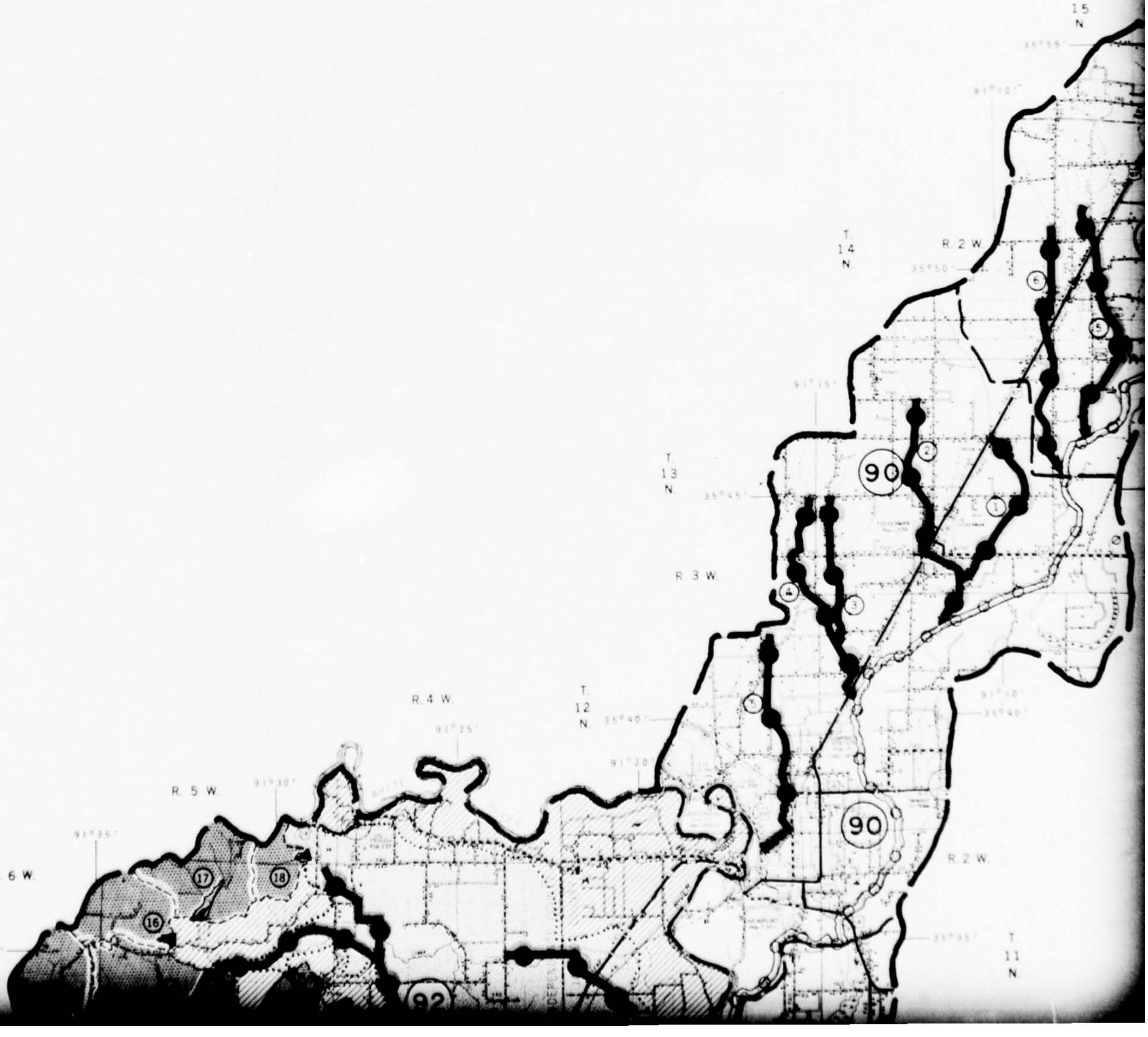
LEGEND

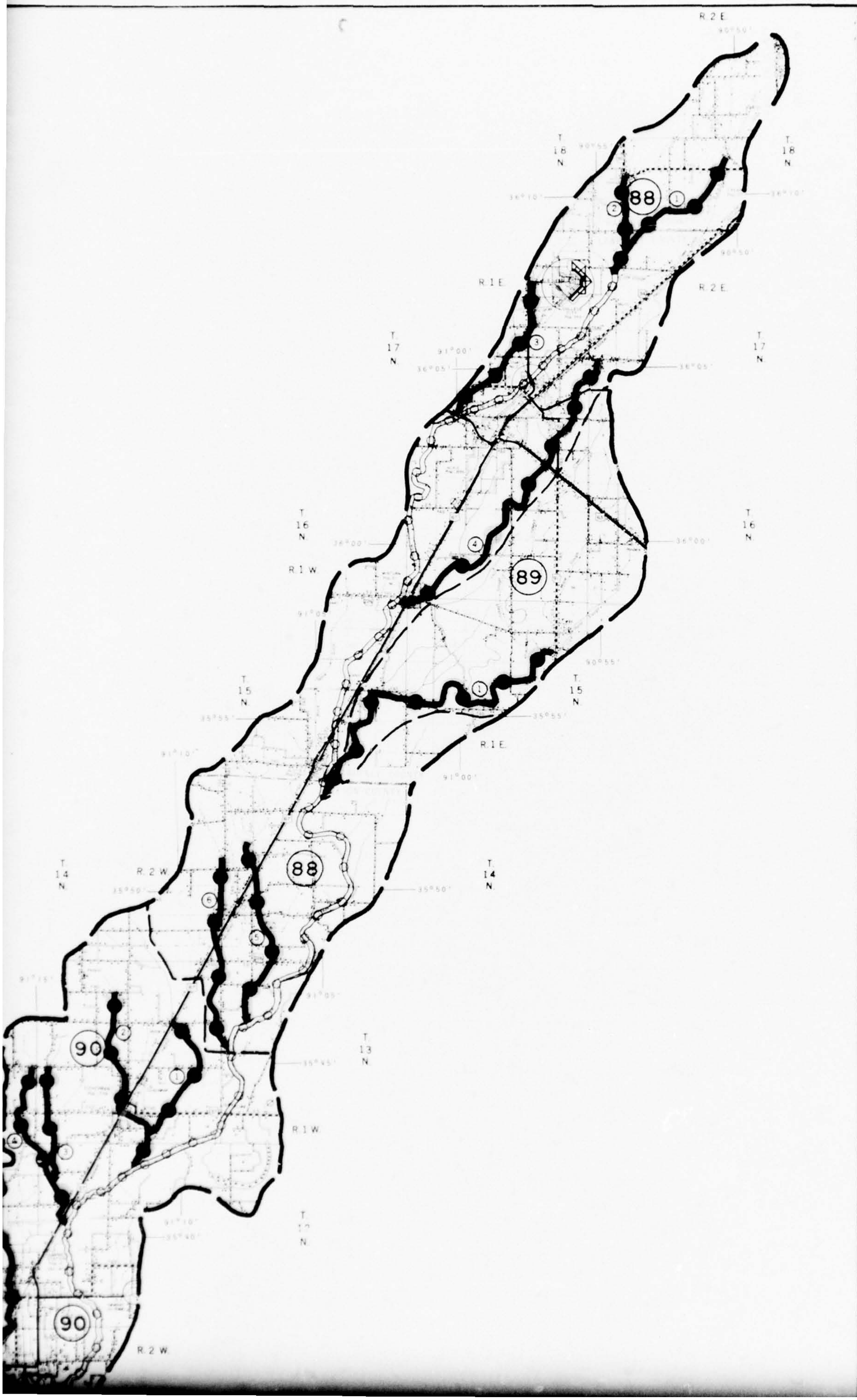
- Paved Road
- Dirt Road
- Railroad
- Drainage
- Town or Community
- County Line
- Basin Boundary
- Watershed Boundary
- (88) Watershed Number
- Floodwater Retarding Structure
- Multiple Purpose Structure (I-Irrigation, S-Municipal & Industrial Storage)
- (2) Channel Improvement for Flood Prevention and Drainage
- Channel Improvement Proposed by Corps of Engineers
- DP Drainage Pump
- (6) Structure Site Number
- Drainage Area Controlled by Structure
- Benefited Area
- Area not Benefited
- Outlet Structure

(92)

DEPARTEE CREEK AND WHITE RIVER LATERALS

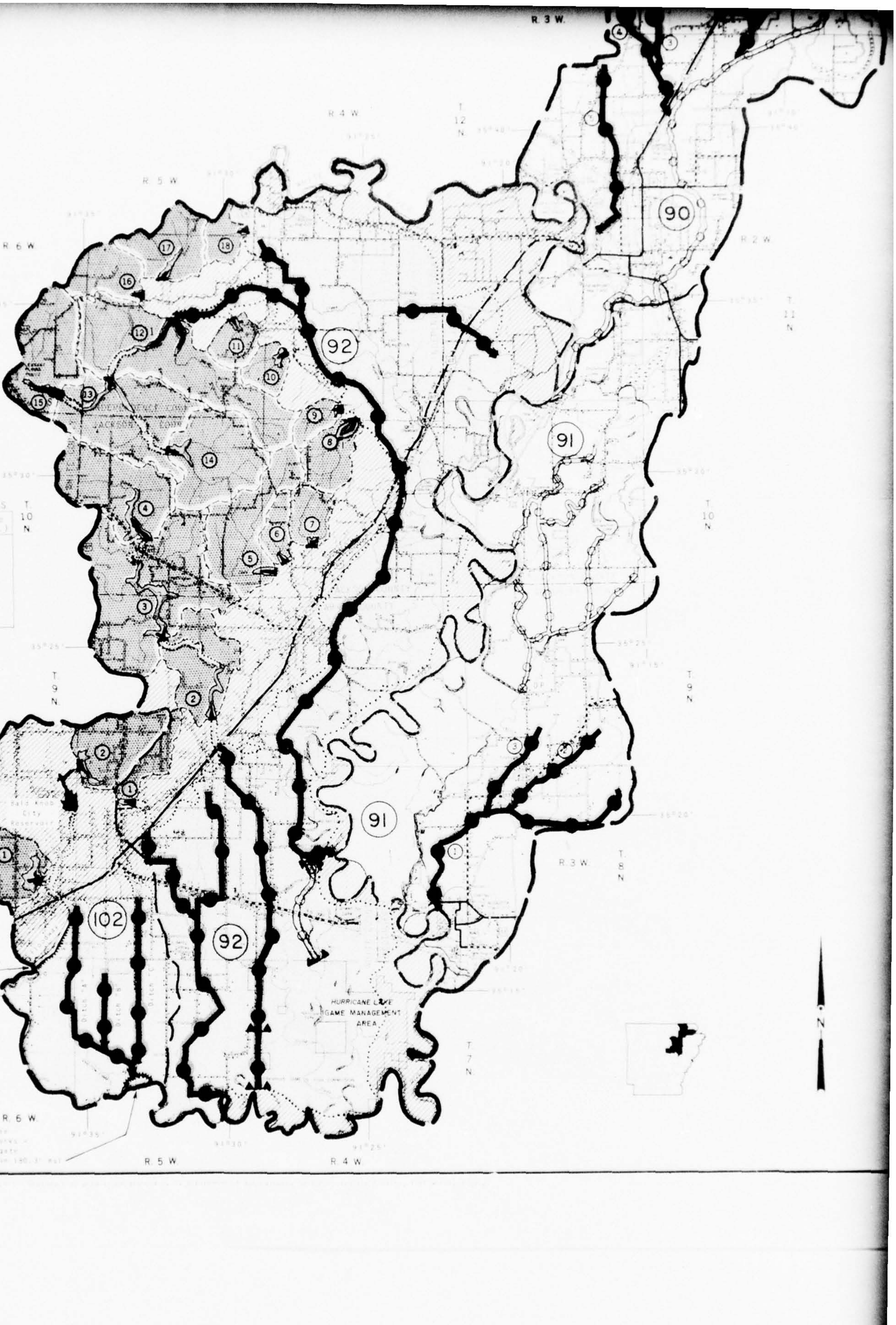
Site Number	Drainage Area-Acres
1	1,536
2	4,160
3	9,792
4	7,104
5	5,568
6	896
7	1,920
8	2,112
9	1,408
10	1,344
11	1,472
12	10,048
13	6,912
14	5,312
15	4,864
16	2,496
17	3.328
18	960





R.2E.
T.
18
N.
R.1E.
R.2E.
T.
17
N.
T.
16
N.
R.1W.
89
T.
15
N.
R.1E.
88
T.
14
N.
R.2W.
90
T.
13
N.
R.1W.
T.
12
N.
90
R.2W.

1	1,636
2	4,160
3	9,792
4	7,104
5	5,568
6	896
7	1,920
8	2,112
9	1,408
10	1,344
11	1,472
12	10,048
13	6,912
14	5,312
15	4,864
16	2,496
17	3,328
18	960



92

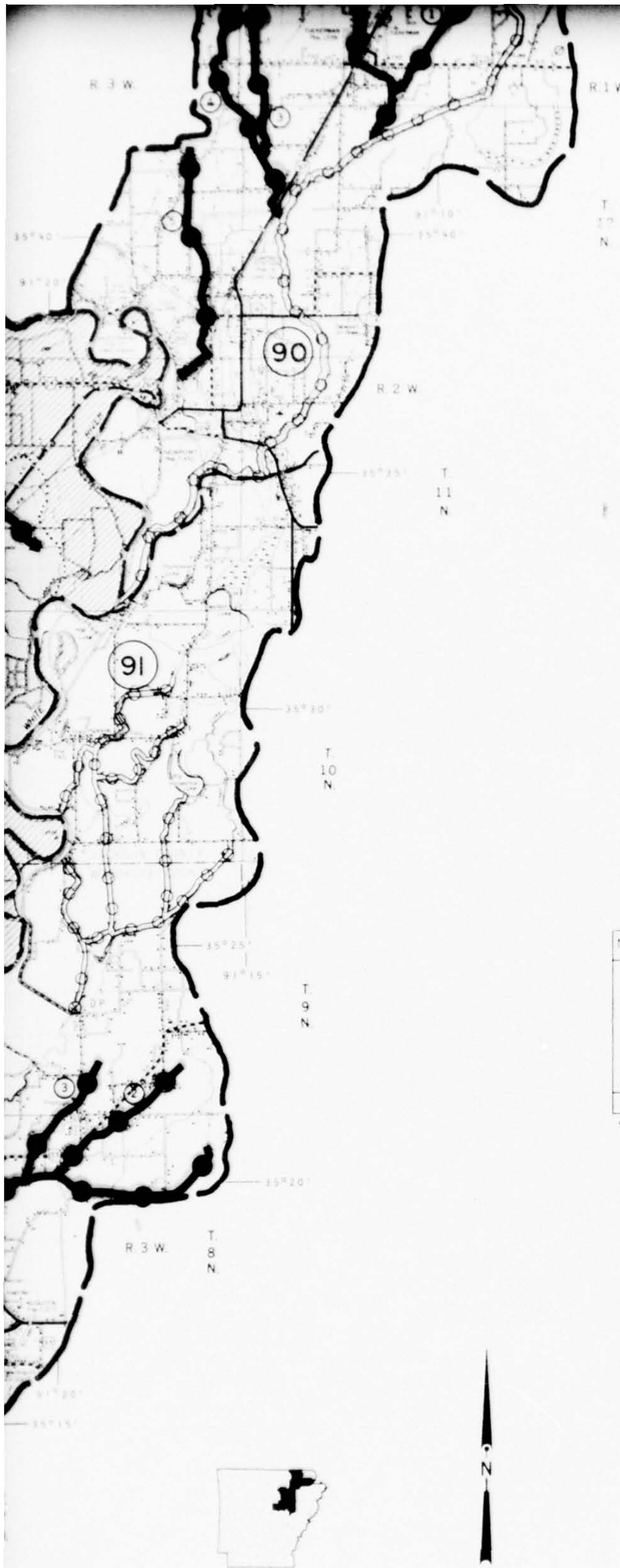
DEPARTEE CREEK
REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
2	3,000	11	2,500
5	9,700	12	7,400
6	2,000	13	9,100
8	4,000	14	9,400
9	1,800	15	10,000
10	500	17	8,200
		18	2,400

102

OVERFLOW CREEK AND LITTLE RED RIVER

Site Number	Drainage Area-Acres
1	5,568
2	3,392



No.	Watershed	*Drainage Area (Sq. Mi.)
88	Upper Village Creek	167
89	Lick Pond Ditch	43
90	Village Creek-Swan Pond Reach	106
91	Lower Village (Mayberry)	130
92	Departee Creek - White River Laterals	350
102	Overflow Creek - Little Red River	61
	Reach Total	857

* Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN COMPREHENSIVE STUDY

WHITE RIVER ABOVE MOUTH OF BLACK RIVER
TO ABOVE MOUTH OF LITTLE RED RIVER

REACH NO. 20

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

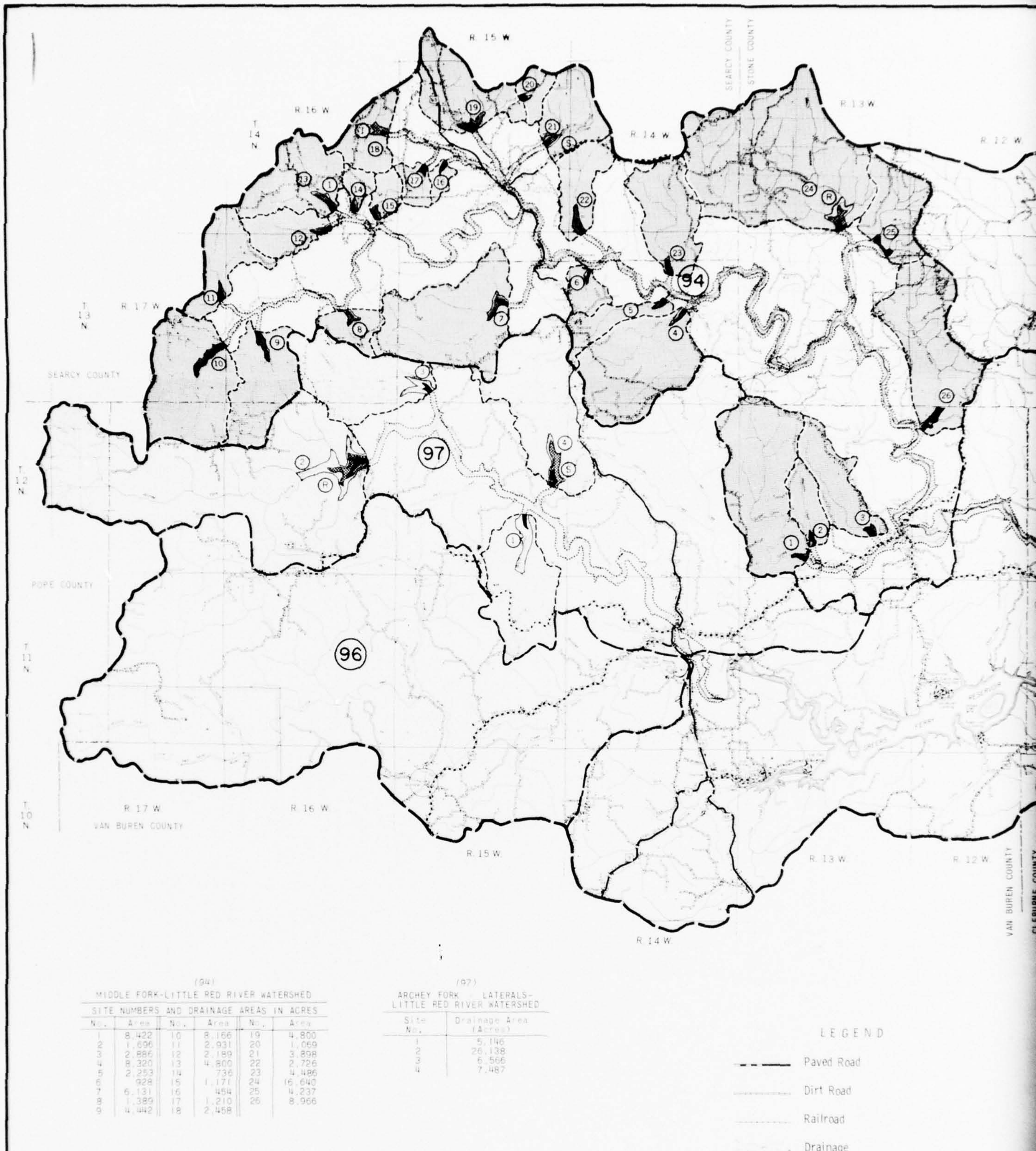
1 0 1 2 3 4
MILES

APPROXIMATE DRAINAGE AREA 857 SQUARE MILES

Rev. 3-68 4-R-21,807
Rev. 3-66 4-R-19588

PLATE No. P-40

4



(94)
MIDDLE FORK-LITTLE RED RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	8,422	10	8,166	19	4,800
2	1,696	11	2,931	20	1,069
3	2,886	12	2,189	21	3,898
4	8,320	13	4,800	22	2,726
5	2,253	14	736	23	4,486
6	928	15	1,171	24	16,640
7	6,131	16	454	25	4,237
8	1,389	17	1,210	26	8,966
9	4,442	18	2,458		

(97)
ARCHEY FORK - LATERALS-
LITTLE RED RIVER WATERSHED

Site No.	Drainage Area (Acres)
1	5,146
2	26,138
3	6,566
4	7,487

(100)
BIG CREEK - MAINSTEM
LITTLE RED RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	2,790	6	461	11	11,424
2	909	7	2,938	12	1,594
3	589	8	21,498	13	1,190
4	1,722	9	18,067	14	2,682
5	1,504	10	17,075	15	4,186

(101)
INDIAN CREEK - LITTLE RED RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1	3,347	6	1,318	11	3,014
2	2,547	7	493	12	742
3	589	8	26,304	13	685
4	640	9	1,613	14	1,459
5	4,576	10	1,011		

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
MIDDLE FORK-LITTLE RED RIVER:							
1	20,500	7	19,600	13	1,000	21	1,000
2	5,400	8	4,400	14	1,000	22	8,800
3	9,200	9	14,500	15	3,800	23	14,000
4	20,600	10	14,800	16	1,500	24	11,100
5	4,000	11	9,400	17	3,900	25	5,000
6	2,900	12	4,300	18	7,200		

LEGEND

Paved Road
Dirt Road
Railroad
Drainage
Town or Community
County Line
Pipe Line
Basin Boundary
Watershed Boundary
99 Watershed Number
Floodwater Retarding Structure
Multiple Purpose Structure I-Irrigation, S-Municipal & Industrial, R-Recreation Storage
Structure Site Number

3	2,886	12	2,189	21	[illegible]
4	8,320	13	4,800	22	2,726
5	2,253	14	736	23	4,486
6	928	15	1,171	24	16,640
7	6,131	16	454	25	4,237
8	1,389	17	1,210	26	8,966
9	4,442	18	2,458		

3	6,566
4	7,487

(100)
BIG CREEK - MAINSTEM
LITTLE RED RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	2,790	6	461	11	11,424
2	909	7	2,938	12	1,594
3	589	8	21,498	13	1,190
4	1,722	9	18,067	14	2,682
5	1,504	10	17,075	15	4,186

(101)
INDIAN CREEK - LITTLE RED RIVER WATERSHED

SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	3,347	6	1,318	11	3,014
2	2,547	7	493	12	742
3	589	8	26,304	13	685
4	640	9	1,613	14	1,459
5	4,576	10	1,011		

2

REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES

Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
MIDDLE FORK-LITTLE RED RIVER:							
1	20,500	7	19,600	13	1,000	21	1,000
2	5,400	8	4,400	14	1,000	22	8,800
3	9,200	9	14,500	15	3,800	23	14,000
4	20,600	10	14,800	16	1,500	24	11,100
5	4,000	11	9,400	17	3,900	25	5,000
6	2,900	12	4,300	18	7,200		
ARCHEY FORK - LATERALS-LITTLE RED RIVER:							
1	16,900	2	10,300	3	20,800	4	18,800
BIG CREEK - MAINSTEM LITTLE RED RIVER:							
1	6,300	5	3,700	10	10,000	14	5,700
2	2,100	6	1,100	12	3,900	15	7,700
4	3,000	8	9,000	13	2,400		
INDIAN CREEK-LITTLE RED RIVER:							
2	1,600	5	12,000	9	4,400	12	1,400
3	1,700	6	3,600	10	2,800	14	800
4	1,700	7	1,400	11	7,500		

Paved Road
Dirt Road
Railroad
Drainage
Town or Community
County Line
Pipe Line
Basin Boundary
Watershed Boundary
99 Watershed Number
Floodwater Retarding Structure
Multiple Purpose Structure I-Irrigation, S-Municipal & Industrial, R-Recreation Storage
2 Structure Site Number
Drainage Area Controlled by Structure
Benefited Area

Map No.	Basin Division
94	Middle Fork-Little Red River
95	Greers Ferry Lat. - L. Red Rive
96	Upper S. Fork - Little Red Rive
97	Archey Fork - Lats. - Little Re
98	Turkey - Beech - Raccoon Creeks
99	Red R. - Greers Ferry to Pangbu
100	Big Cr. - Maluster L. Red River
101	Indian Creek - L. Red River

*Preliminary Data

POTENTIA

Dirt Road

Railroad

Drainage

Town or Community

County Line

Pipe Line

Basin Boundary

Watershed Boundary

99 Watershed Number

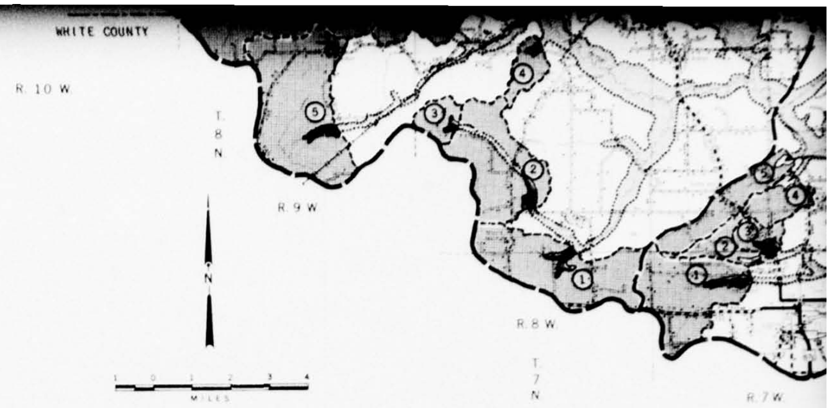
Floodwater Retarding Structure

Multiple Purpose Structure
I-Irrigation, S-Municipal & Industrial, R-Recreation Storage

2 Structure Site Number

Drainage Area Controlled by Structure

Benefited Area



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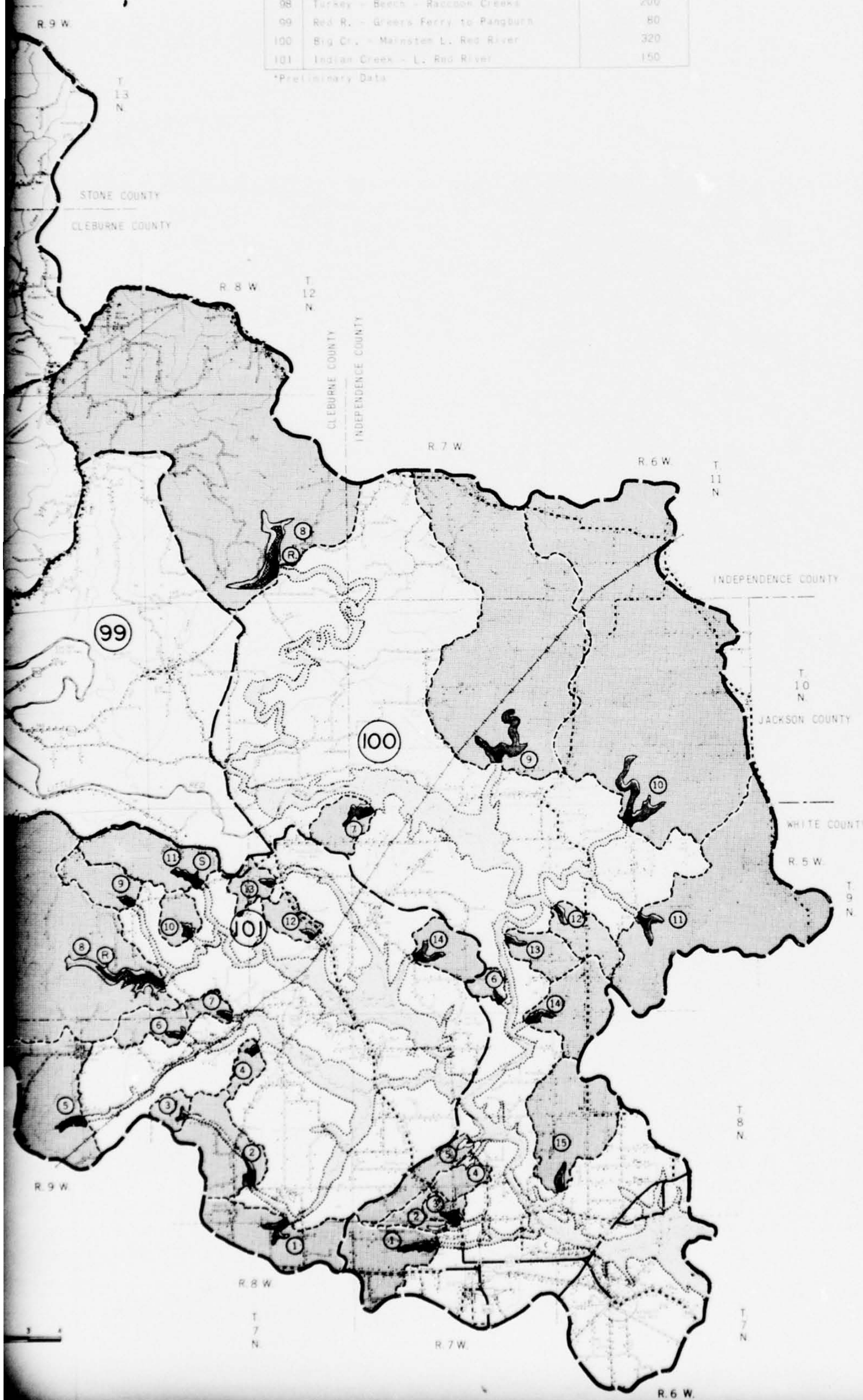
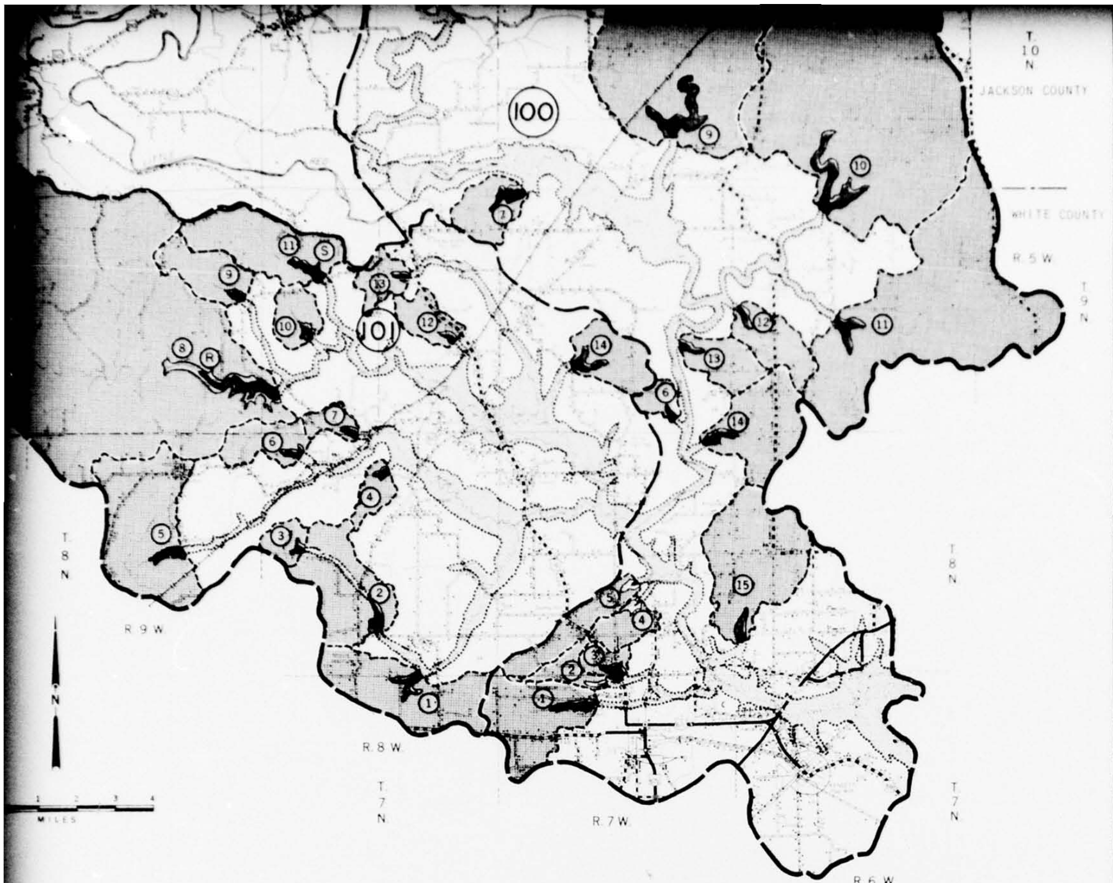
Revised 7

5

Map No.	Basin Division	*Drainage Area (Sq. Mi.)
94	Middle Fork-Little Red River	295
95	Greers Ferry Lat. - L. Red River	344
96	Upper S. Fork - Little Red River	145
97	Archey Fork - Lats. - Little Red River	163
98	Turkey - Beech - Raccoon Creeks	200
99	Red R. - Greers Ferry to Pangburn	80
100	Big Cr. - Mainstem L. Red River	320
101	Indian Creek - L. Red River	150

*Preliminary Data





6

POTENTIAL WORKS OF IMPROVEMENT

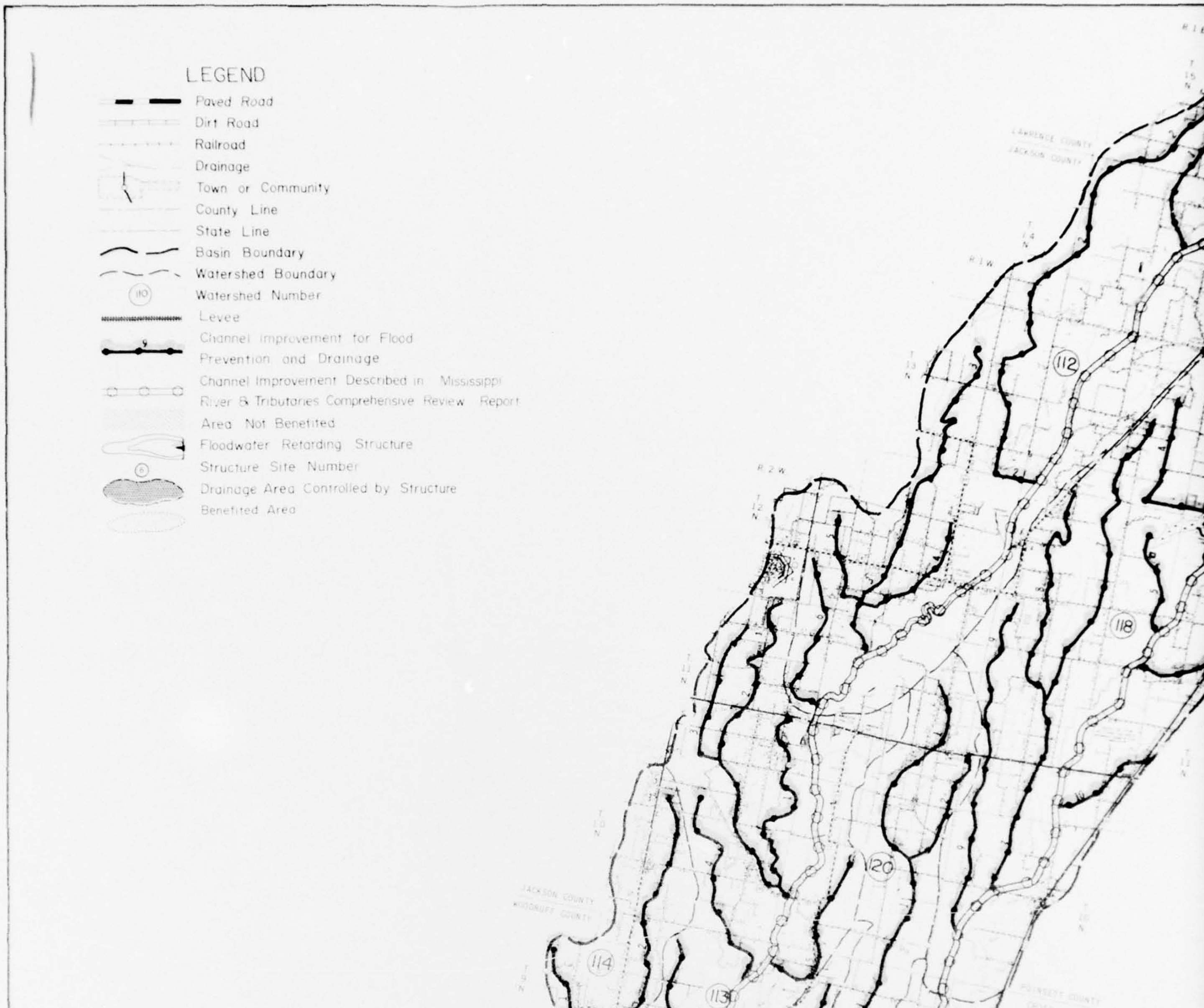
WHITE RIVER BASIN
COMPREHENSIVE STUDY
LITTLE RED RIVER
REACH No. 21

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Rev. 3-68 **4-R-24,539**

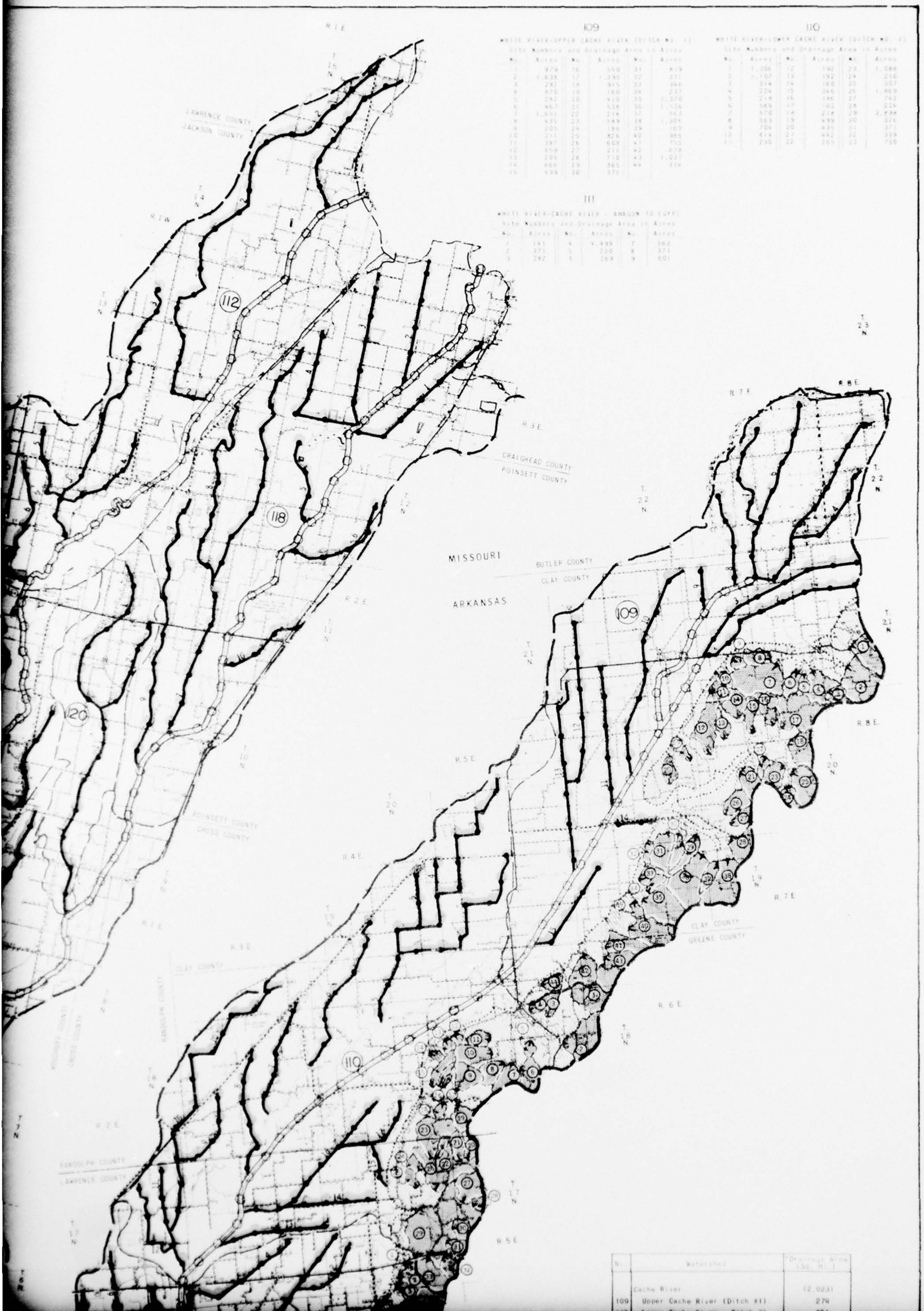
Revised 7-67 April 1965 Base 4-R-19,968

PLATE No. P-41



LEGEND
Paved Road
Dirt Road
Railroad
Drainage
Town or Community
County Line
State Line
Basin Boundary
Watershed Boundary
Watershed Number
Levee
Channel Improvement for Flood Prevention and Drainage
Channel Improvement Described in Mississippi River & Tributaries Comprehensive Review Report
Area Not Benefited
Floodwater Retarding Structure
Structure Site Number
Drainage Area Controlled by Structure
Benefited Area
LAWRENCE COUNTY
JACKSON COUNTY
R 1 W
R 2 W
R 3 W
R 4 W
112
118
120
114
113
121
115
119
116
JACKSON COUNTY
WOODRUFF COUNTY
POINSETT COUNTY
CROSS COUNTY
CLAY COUNTY
RANDOLPH COUNTY
LAWRENCE COUNTY
WHITE COUNTY
PRAIRIE COUNTY
R 2 E
R 3 E

2



109

WHITE RIVER-UPPER CACHE RIVER (DITCH NO. 1)

Site Numbers and Drainage Area in Acres

No.	Acres	No.	Acres	No.	Acres
1	979	16	550	31	819
2	1,638	17	1,395	32	271
3	282	18	915	33	346
4	870	19	160	34	237
5	282	20	910	35	1,378
6	467	21	538	36	1,516
7	1,651	22	218	37	563
8	435	23	549	38	1,304
9	205	24	186	39	160
10	211	25	826	40	985
11	397	26	608	41	755
12	659	27	211	42	478
13	205	28	710	43	1,037
14	666	29	365	44	314
15	499	30	371		

110

WHITE RIVER-LOWER CACHE RIVER (DITCH NO. 1)

Site Numbers and Drainage Area in Acres

No.	Acres	No.	Acres	No.	Acres
1	1,306	12	192	23	1,088
2	1,107	13	192	24	256
3	314	14	160	25	307
4	224	15	346	26	1,869
5	218	16	186	27	742
6	589	17	162	28	224
7	570	18	218	29	2,898
8	563	19	499	30	326
9	704	20	435	31	371
10	614	21	442	32	339
11	230	22	205	33	736

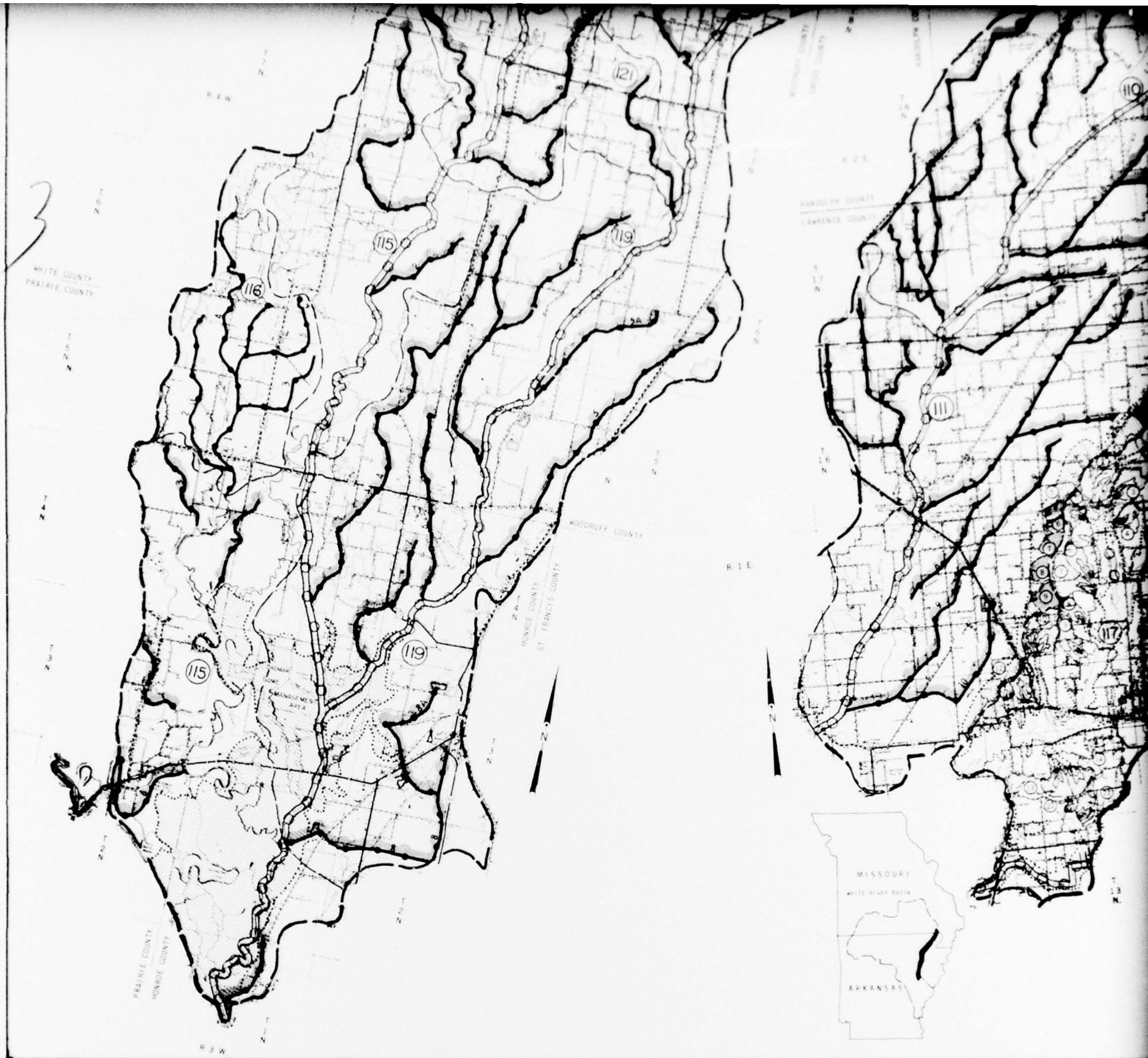
111

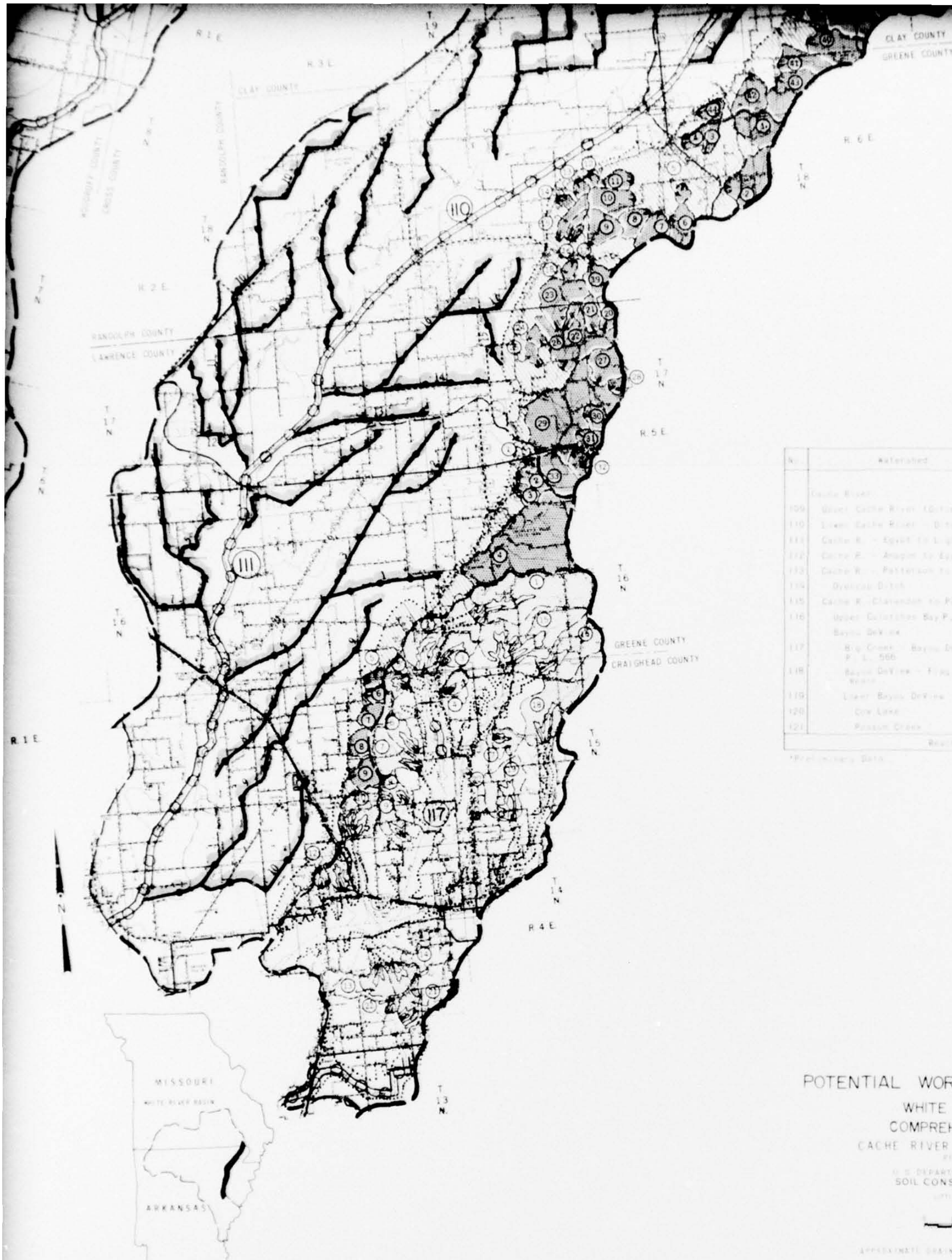
WHITE RIVER-CACHE RIVER - AMAGON TO EGYPT

Site Numbers and Drainage Area in Acres

No.	Acres	No.	Acres	No.	Acres
1	141	4	4,499	7	563
2	371	5	230	8	371
3	282	6	269	9	601

No.	Watershed	Drainage Area (Sq. Mi.)
	Cache River	(2,023)
109	Upper Cache River (Ditch #1)	274
110	Lower Cache River - Ditch #1	251


3
WHITE COUNTY
PRAIRIE COUNTY
WOODRUFF COUNTY
MONROE COUNTY
ST FRANCIS COUNTY
PRAIRIE COUNTY
MONROE COUNTY
RANDOLPH COUNTY
LAWRENCE COUNTY
R 1 E
R 3 W
R 4 W
MISSOURI
ARKANSAS
121
115
119
116
115
119
110
111
117



No.	Watershed	*Drainage Area (Sq. Mi.)
	Cache River	(2,023)
109	Upper Cache River (Ditch 81)	274
110	Lower Cache River - Ditch 81	251
111	Cache R. - Egypt to Light	160
112	Cache R. - Anagon to Egypt	186
113	Cache R. - Patterson to Anagon	183
114	Overcup Ditch	35
115	Cache R. Clarendon to Patterson	199
116	Upper Cutoff Bay P. L. 566	61
	Bayou DeView	(594)
117	Big Creek - Bayou DeView P. L. 566	114
118	Bayou DeView - Flag Slough Reach	190
119	Lower Bayou DeView	329
120	Cow Lake	94
121	Possum Creek	17
	Reach Total	2,023

*Preliminary Data

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN

COMPREHENSIVE STUDY

CACHE RIVER AND BAYOU DeVIEW

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

LITTLE ROCK, ARKANSAS

MILES

Rev. 3-68 4-R-21920

Rev. 3-68 4-R-19930

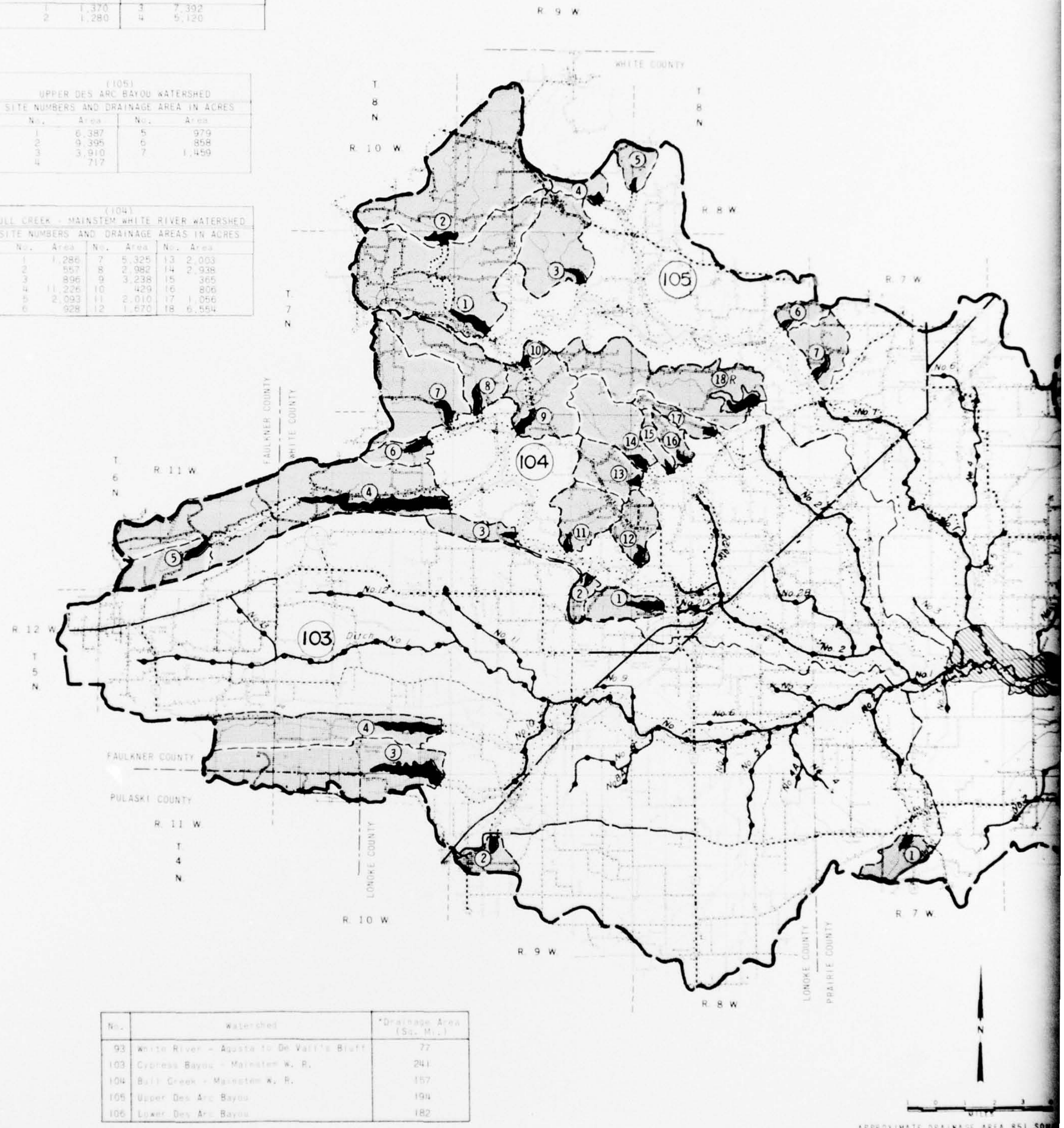
PLATE No. P-42

4

(103) CYPRESS CREEK - MAINSTEM WHITE RIVER WATERSHED			
SITE NUMBERS AND DRAINAGE AREA IN ACRES			
No.	Area	No.	Area
1	1,370	3	7,392
2	1,280	4	5,120

(105) UPPER DES ARC BAYOU WATERSHED			
SITE NUMBERS AND DRAINAGE AREA IN ACRES			
No.	Area	No.	Area
1	6,387	5	979
2	9,395	6	858
3	3,910	7	1,459
4	717		

(104) BULL CREEK - MAINSTEM WHITE RIVER WATERSHED					
SITE NUMBERS AND DRAINAGE AREAS IN ACRES					
No.	Area	No.	Area	No.	Area
1	1,286	7	5,325	13	2,003
2	557	8	2,982	14	2,938
3	896	9	3,238	15	365
4	11,226	10	429	16	806
5	2,093	11	2,010	17	1,056
6	928	12	1,670	18	6,554

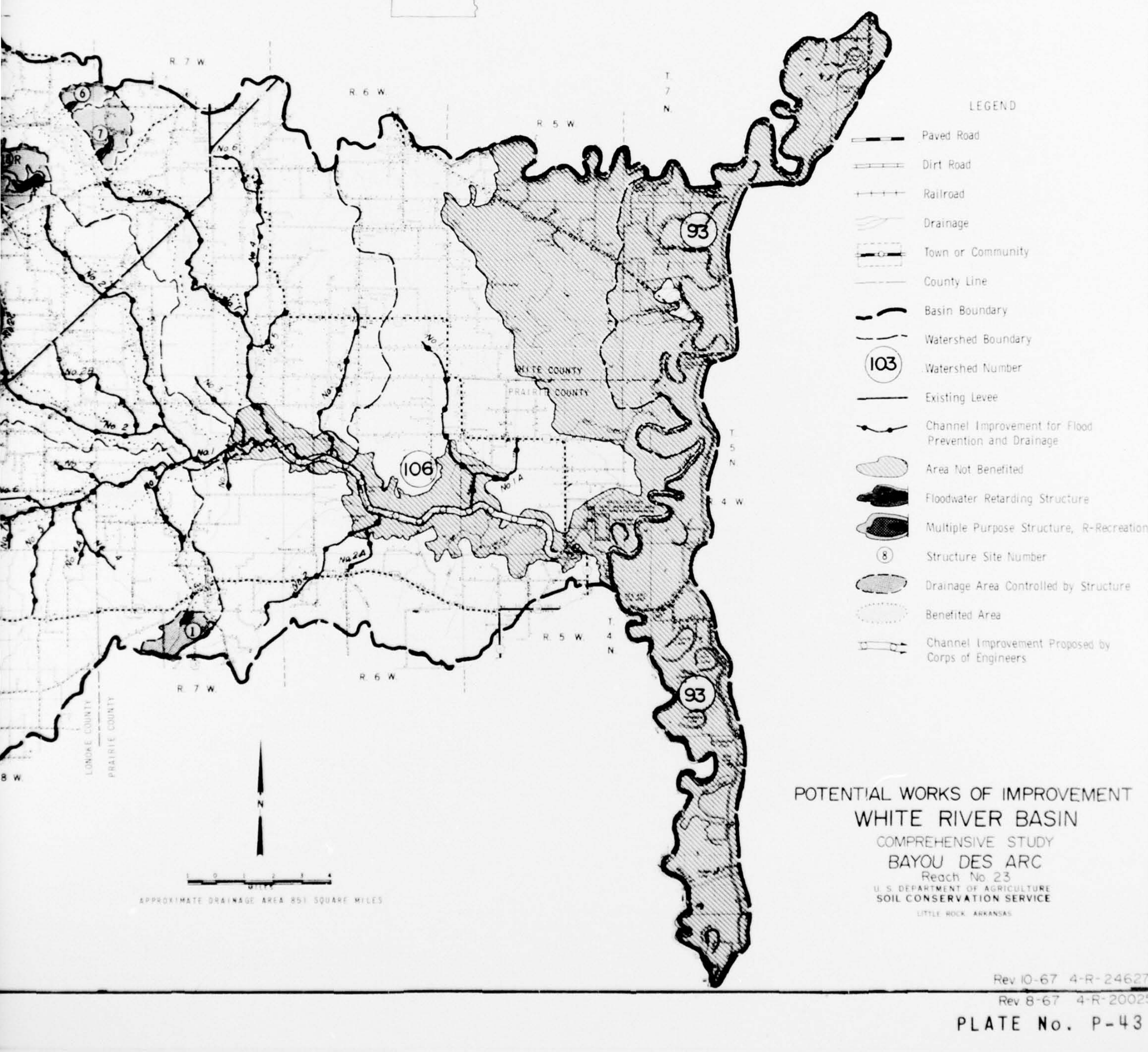


No.	Watershed	*Drainage Area (Sq. Mi.)
93	White River - Agusta to De Vall's Bluff	77
103	Cypress Bayou - Mainstem W. R.	241
104	Bull Creek - Mainstem W. R.	157
105	Upper Des Arc Bayou	194
106	Lower Des Arc Bayou	182

*Preliminary Data

2

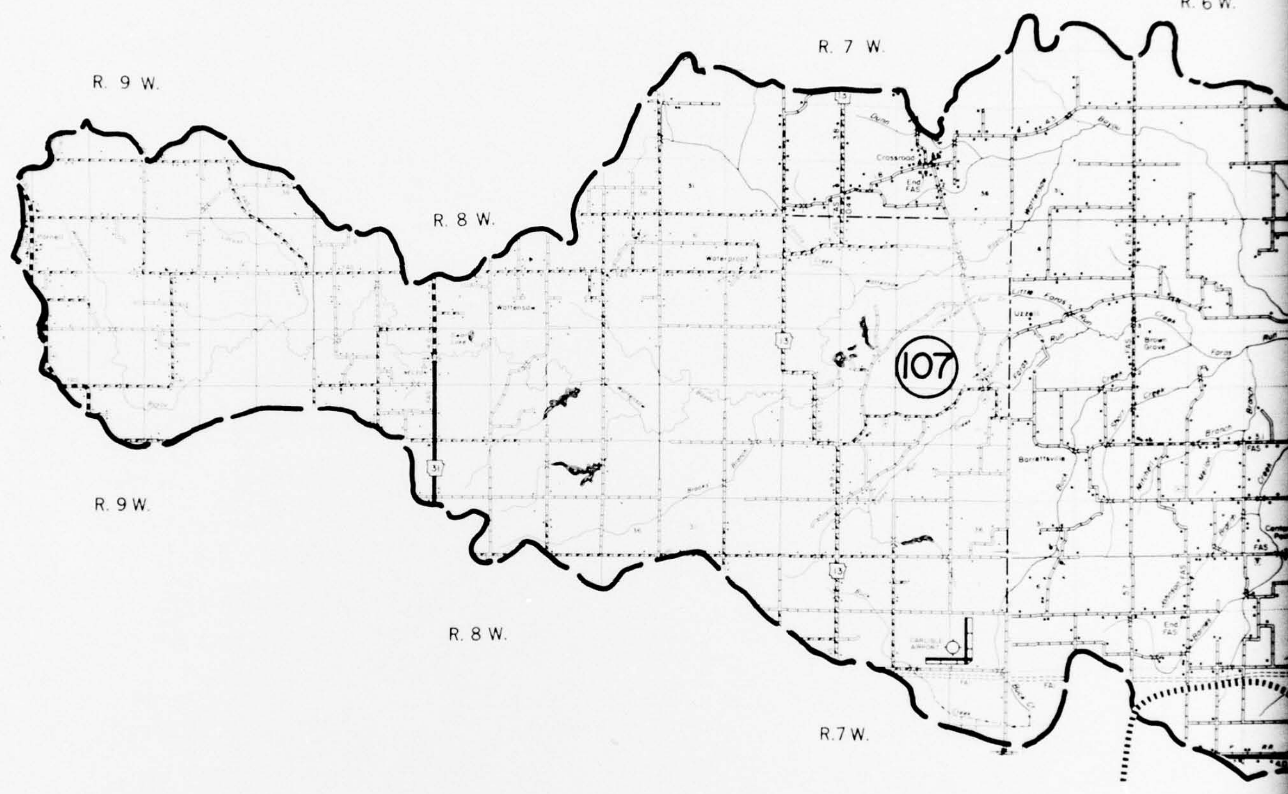
REMAINING STORAGE CAPACITY AVAILABLE FOR OTHER PURPOSES							
Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)	Site No.	Storage (Ac. Ft.)
CYPRESS CREEK - MAINSTEM WHITE RIVER:							
2	3,000	3	2,800	4	12,600		
BULL CREEK - MAINSTEM WHITE RIVER:							
1	3,000	6	2,300	10	5,600	15	900
2	1,400	7	12,000	12	4,200	16	2,100
3	2,300	8	7,500	13	5,100	17	3,100
5	3,600	9	7,100	14	7,600	18	16,100
UPPER DES ARC BAYOU:							
1	16,000	3	10,200	5	2,600	7	3,800
2	6,000	4	800	6	2,300		



POTENTIAL WORKS OF IMPROVEMENT
WHITE RIVER BASIN
COMPREHENSIVE STUDY
BAYOU DES ARC
Reach No. 23
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Rev 10-67 4-R-24627
Rev 8-67 4-R-20025

PLATE No. P-43



L E G E N D

Basin Boundary

Watershed Boundary

107 Watershed Number

Grand Prairie Project Boundary

Map No.	Basin Division	Watershed *Drainage Area (Sq. Mi.) Gross	Net
107	Wattensaw Bayou & W. R. Laterals	295	295

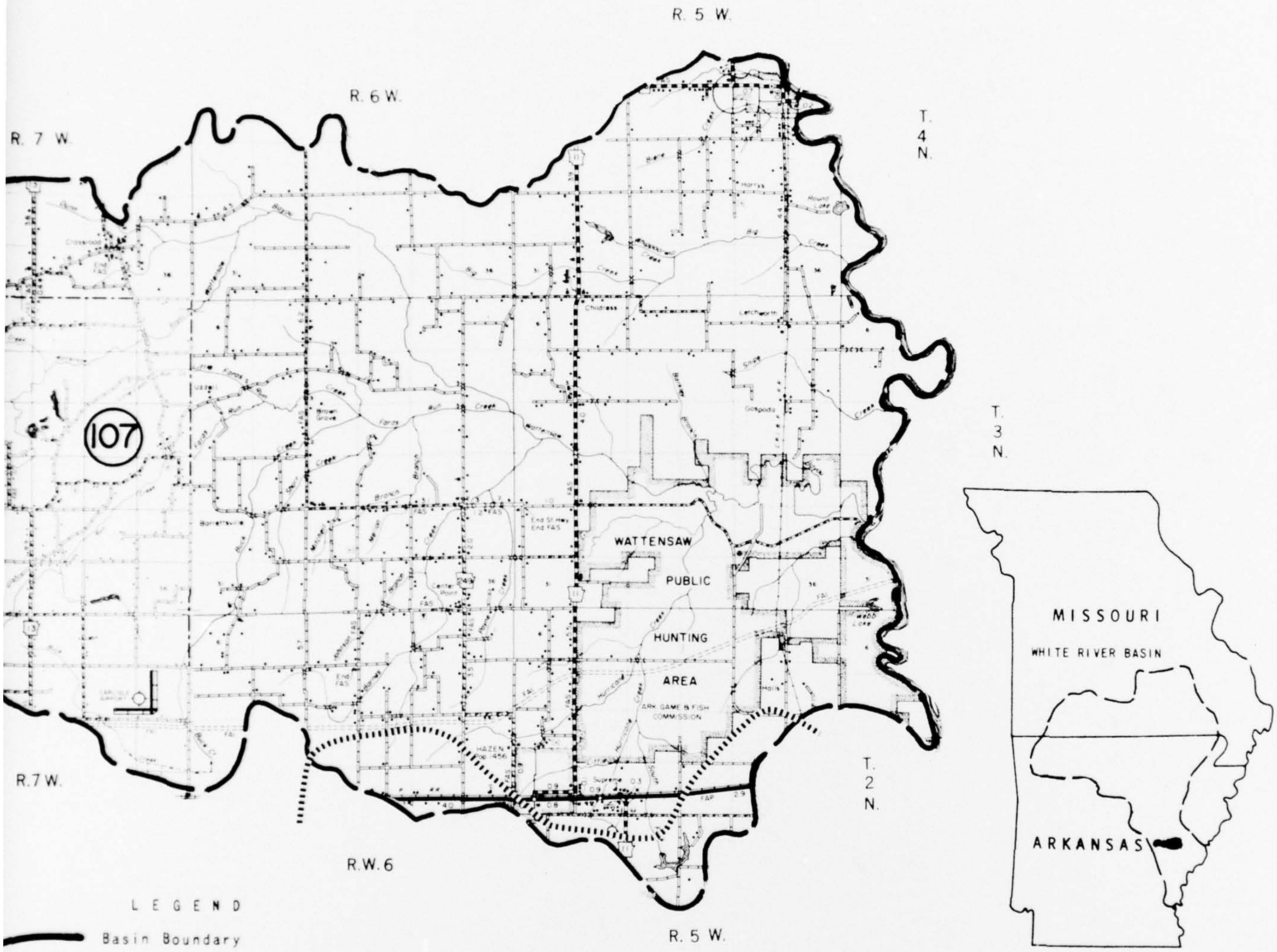
*Preliminary Data

N

Base from General Highway Maps - 1961-1963 - Reproduction permission granted U. S. Department of Agriculture, Soil Conservation Service, Fort Worth, Texas.

USDA-SCS-FORT WORTH, TEX. 1968

2



LEGEND

Basin Boundary

Watershed Boundary

(107) Watershed Number

Grand Prairie Project Boundary

Basin Division	Watershed *Drainage Area (Sq. Mi.) Gross	Net
Bayou & W. R. Laterals	295	295

ata

N

POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN COMPREHENSIVE STUDY

WATTENSAW BAYOU

Reach No. 24

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

LITTLE ROCK, ARKANSAS

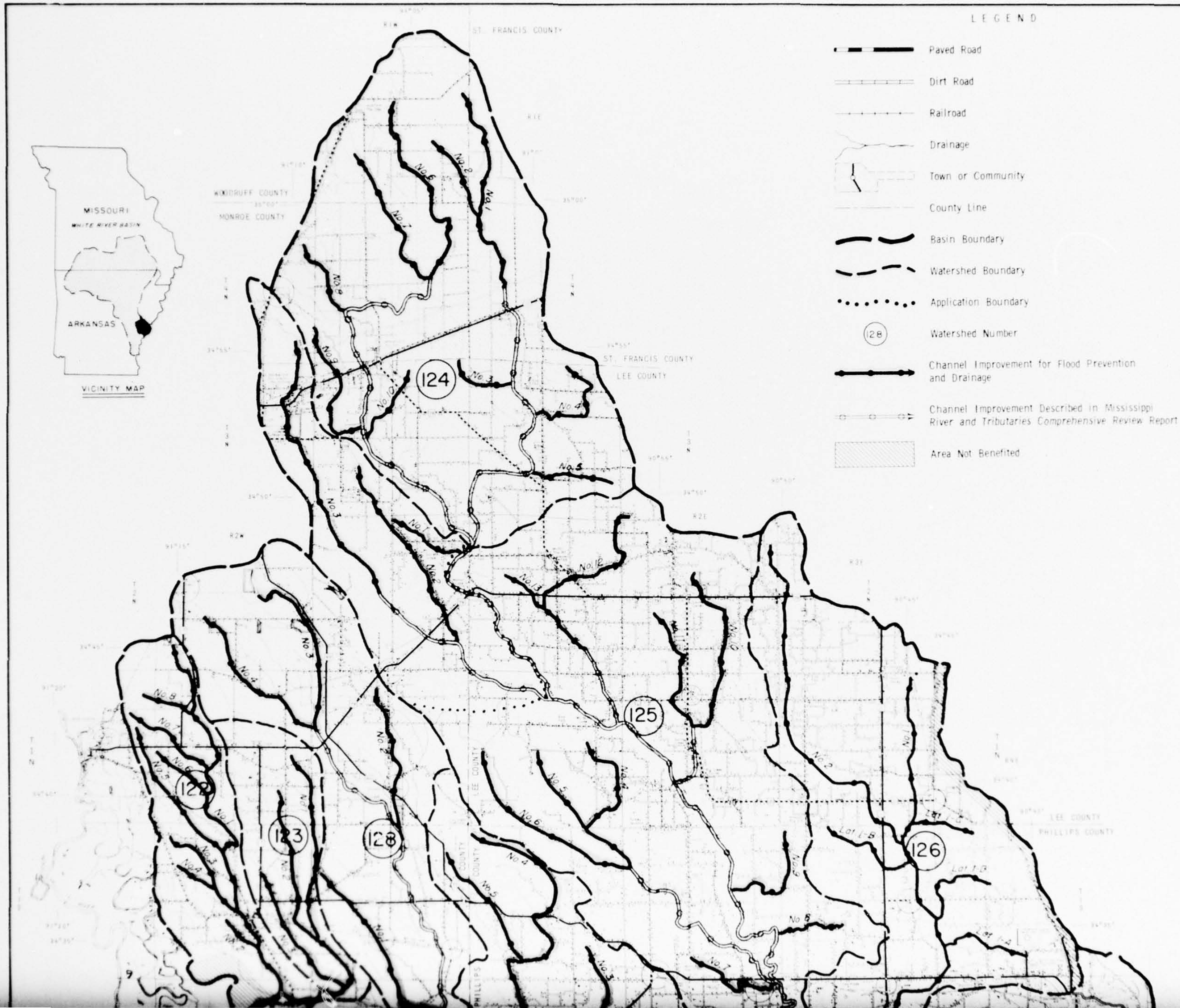
MILES

Rev. 9-67 4-R-24715

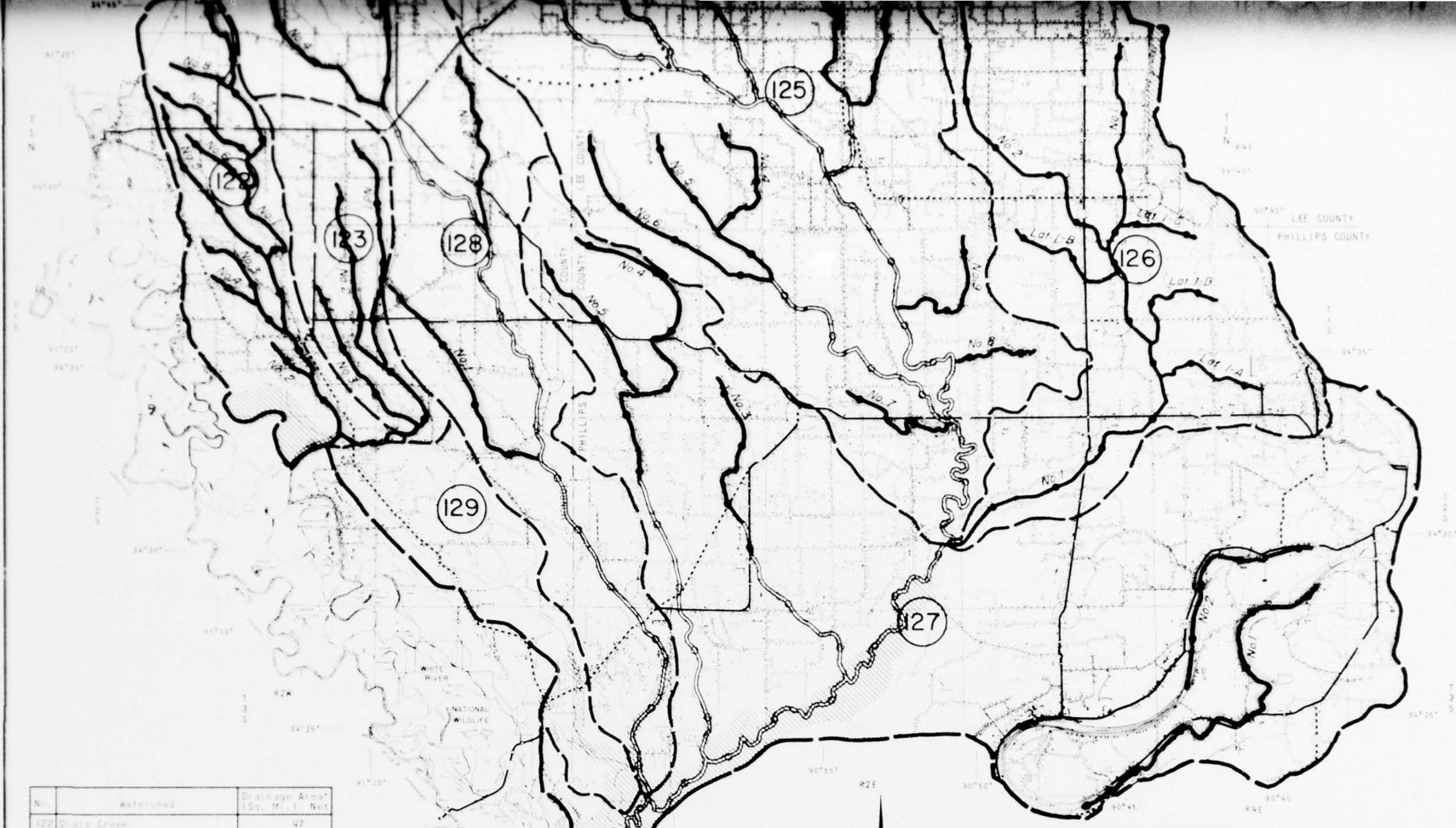
Conservation Service, Fort Worth, Texas.

Rev. 3-66 4-R-19974

PLATE No. P-44



LEGEND
Paved Road
Dirt Road
Railroad
Drainage
Town or Community
County Line
Basin Boundary
Watershed Boundary
Application Boundary
128
Watershed Number
Channel Improvement for Flood Prevention and Drainage
Channel Improvement Described in Mississippi River and Tributaries Comprehensive Review Report
Area Not Benefited
MISSOURI
WHITE RIVER BASIN
ARKANSAS
VICINITY MAP
WOODRUFF COUNTY
MONROE COUNTY
ST. FRANCIS COUNTY
LEE COUNTY
PHILLIPS COUNTY
124
125
126
123
128
122



POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN COMPREHENSIVE STUDY

BIG AND DIALS CREEKS

REACH NO. 25

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

LITTLE ROCK, ARKANSAS

Approximate Drainage Area 1,107 Square Miles

No.	Watershed	Drainage Area* (Sq. Mi.) Net
122	Dials Creek	47
123	Big Slash	33
	Big Creek	1,027
124	Big Creek - Flat Fork Reach	166
125	Big Creek - Piney Fork Reach	280
126	Lee - Phillips Watershed P. L. 566	130
127	Lower Big Creek	284
128	Big Cypress - Big Creek	133
129	Prairie Cypress - Big Creek	34

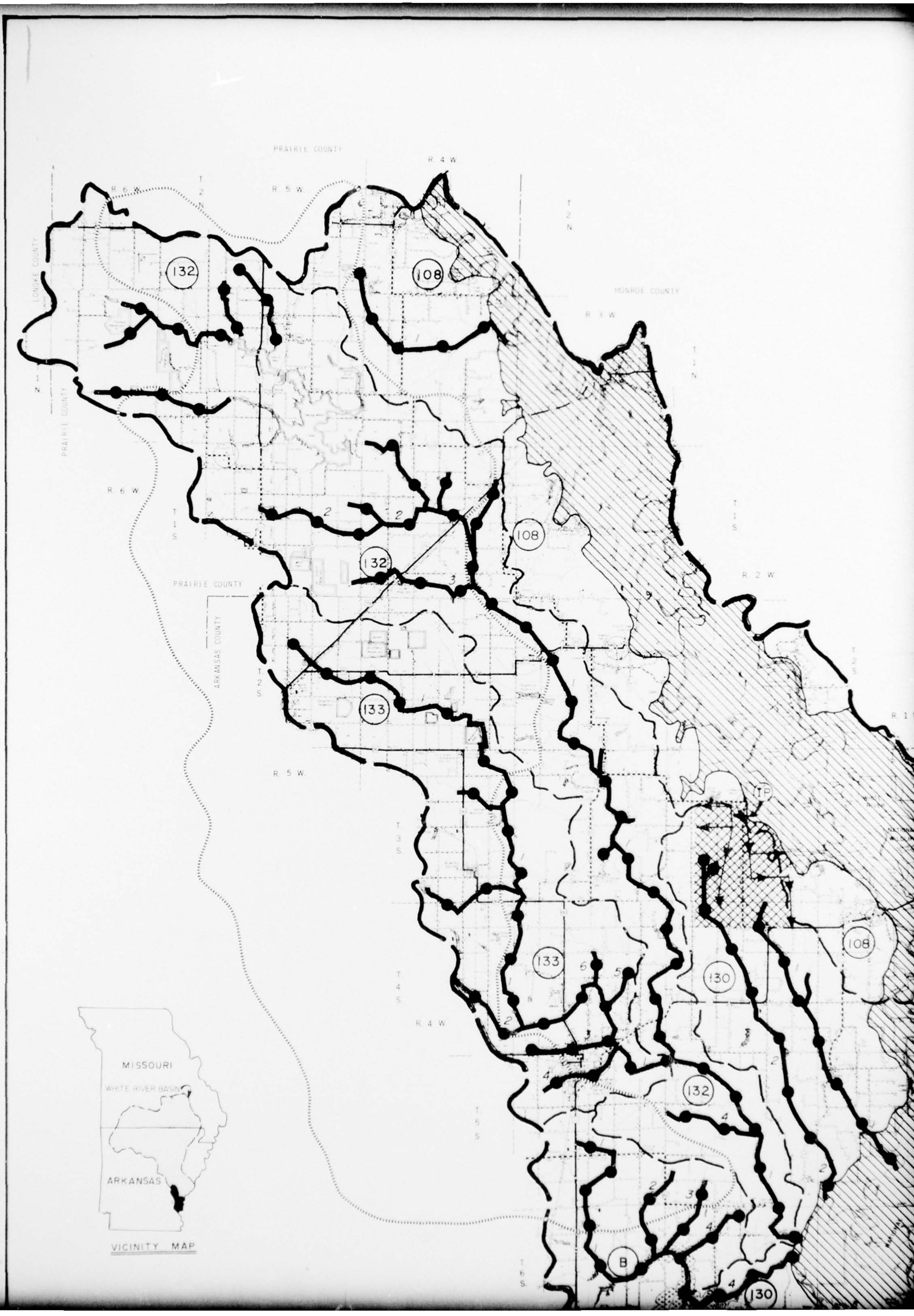
*Preliminary Data

Rev. 3-68 4-R-21144

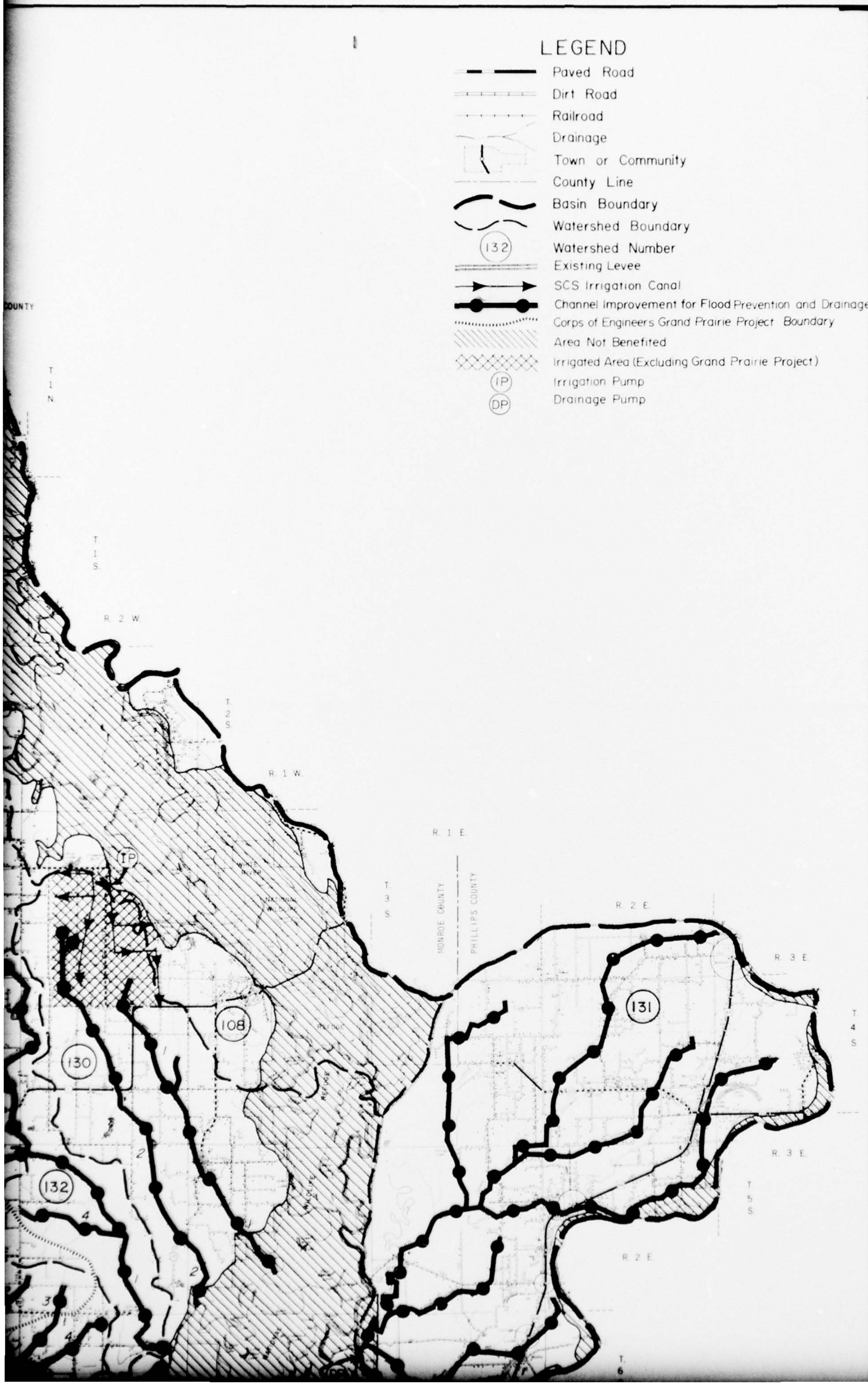
Rev 2-66 4-R-19374

PLATE No. P-45

2



PRAIRIE COUNTY
R. 4 W.
R. 6 W.
R. 5 W.
T. 2 N.
T. 1 N.
LONOKE COUNTY
PRAIRIE COUNTY
MONROE COUNTY
R. 3 W.
R. 2 W.
R. 1 W.
T. 1 S.
T. 2 S.
T. 3 S.
T. 4 S.
T. 5 S.
T. 6 S.
ARKANSAS COUNTY
132
108
133
130
TP
B
MISSOURI
WHITE RIVER BASIN
ARKANSAS
VICINITY MAP

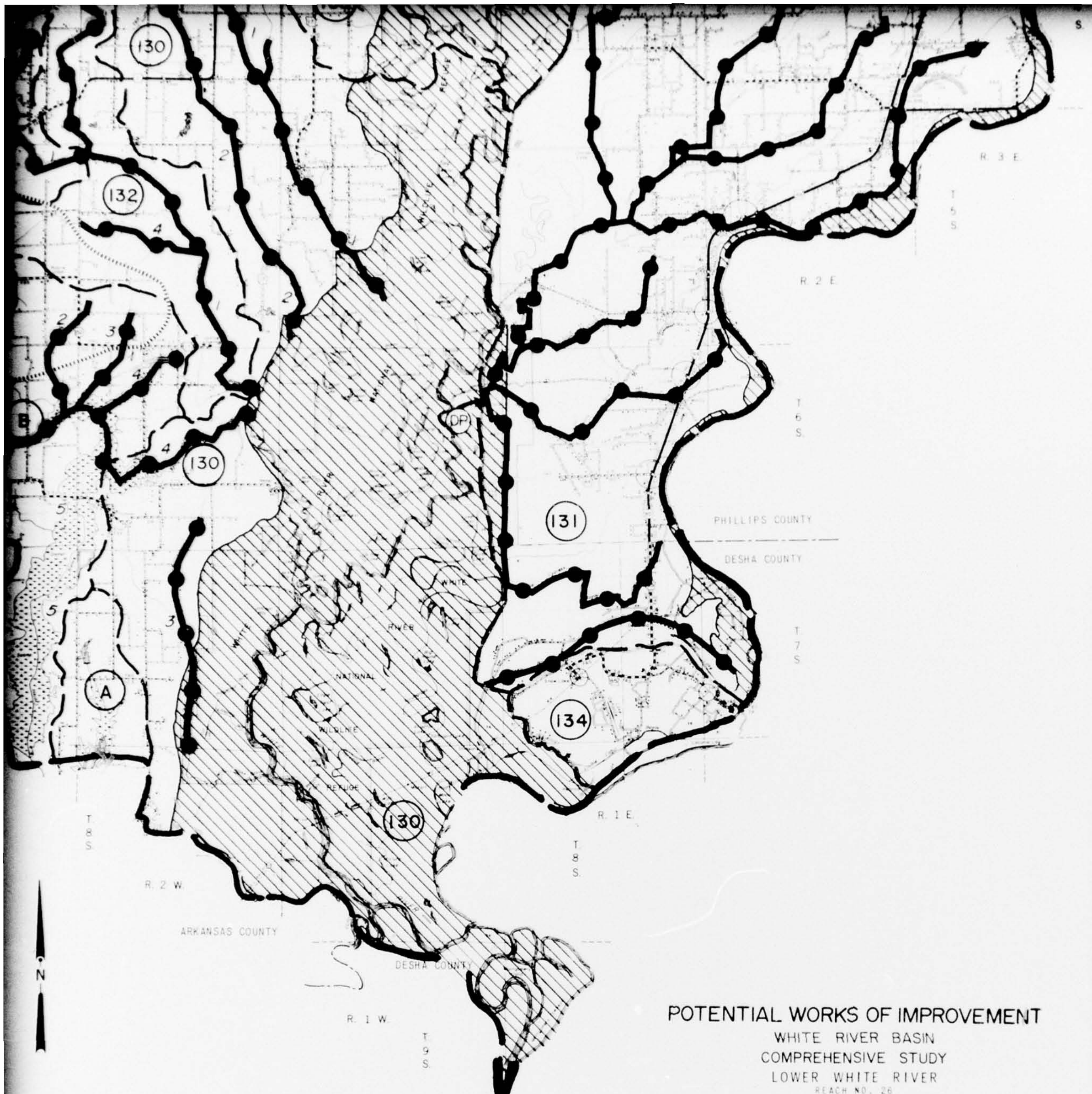

LEGEND
Paved Road
Dirt Road
Railroad
Drainage
Town or Community
County Line
Basin Boundary
Watershed Boundary
132
Watershed Number
Existing Levee
SCS Irrigation Canal
Channel Improvement for Flood Prevention and Drainage
Corps of Engineers Grand Prairie Project Boundary
Area Not Benefited
Irrigated Area (Excluding Grand Prairie Project)
IP
Irrigation Pump
DP
Drainage Pump
COUNTY
T. 1 N.
T. 1 S.
R. 2 W.
T. 2 S.
R. 1 W.
R. 1 E.
IP
T. 3 S.
MONROE COUNTY
PHILLIPS COUNTY
R. 2 E.
R. 3 E.
131
T. 4 S.
108
130
R. 3 E.
132
T. 5 S.
R. 2 E.
T. 6

VICINITY MAP

3

No.	Basin Division	*Watershed Area (Sq. Mi.)
108	White River-Devalls Bluff to St. Charles	254
130	Lower White River Tributaries	300
131	White River Backwater Watershed P. L. 566	228
132	Big Bayou Lagrue	256
133	Little Bayou Lagrue	135
134	Laconia Circle Watershed	18
A	Plus 12 sq. mi. of Merisach Lake from Arkansas River	12
B	Plus 70 sq. mi. of Dismal Swamp from Arkansas River	70

*Preliminary Data



POTENTIAL WORKS OF IMPROVEMENT

WHITE RIVER BASIN
COMPREHENSIVE STUDY
LOWER WHITE RIVER
REACH NO. 26

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

1 0 1 2 3 4
MILES

APPROXIMATE DRAINAGE AREA 1,273 SQUARE MILES

Rev. 3-68 4-R-24712
Rev. 4-66 4-R-20017

PLATE No. P-46